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ABSTRACT

This report considers demographic conditions and prospects for the countries of the world with respect to aging. Particular attention is paid to the implications for health care. The information analyzed and presented in this report was obtained from the latest population projections published by the United Nations. The countries are generally classified into the More Developed Regions and the Less Developed Regions and into eight component regions of the world. Following an introduction, basic demographic trends are examined in the areas of numbers, proportions, and age composition of the elderly; balance of the sexes; societal age-dependency patterns; and population distribution. In a section on morbidity and mortality, trends in mortality and life expectancy are discussed, personal factors in longevity are considered, and information on morbidity and functional limitations is presented. In a third section, socioeconomic characteristics and factors in mortality are examined, including the social factors of marital status, living arrangements, familial dependency and multigenerational families, and the size of family and longevity. Other socioeconomic factors considered include economic development and per capita gross national product or income, socioeconomic differentials, economic activity and dependency, physical factors, and health personnel. The report concludes with a discussion of some general implications for health care of the elderly. Seven figures and 21 data tables are distributed throughout the text. (NRB)

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International Trends and Perspectives: Aging

by Jacob S. Siegel
and
Sally L. Hoover

Issued September 1984

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When this report was drafted, the authors were, respectively, Senior Statistician for Demographic Research and Analysis, Population Division, U.S. Bureau of the Census, and Demographic Statistician, Center for Demographic Studies, U.S. Bureau of the Census. Their current affiliations are, respectively, Professorial Lecturer in Demography, Georgetown University, and Director of Research, Gerontological Services, Inc., Maria B. Dwight and Associates. Although this publication was prepared with the support of the Census Bureau, the authors are responsible for the views expressed.

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International Trends and Perspectives: Aging

INTRODUCTION

Demographic factors such as the size of the population, its geographic distribution within a country, and its composition with respect to such characteristics as sex, age, and socioeconomic status, have a significant effect on many types of public needs, such as the needs for health care, education, and housing. Population should be a basic element in public planning, therefore. This is especially true with respect to the health of the population, and particularly the health of the older population. Population should be a factor in formulating health policy and in integrating health policy with national development policy. In this paper, demographic conditions and prospects for the countries of the world with respect to aging will be considered with particular attention to their implications for health care. Demographic factors interact with social, economic, and cultural factors in their impact on the needs for health planning. Health planning is also affected by such factors as the level of economic development, the rate of economic growth, administrative organization,management skills and efficiency, and social organization. These demographic and other factors are dynamic; the condition and characteristics of a nation's population are continually changing, and so its health and other needs continually change.

The latest population projections published by the United Nations have been used in the analysis. These projections are presented by the United Nations in *World Population Prospects as Assessed in 1980*, Population Studies, Series A, No. 78, and in *Demographic Indicators of Countries: Estimates*

Table 1. Total Population and Population in the Older Ages: 1960 to 2020

(In millions. Projections are medium variant)

Region	1960					1980				
	Total population	60 years and over	65 years and over	70 years and over	80 years and over	Total population	60 years and over	65 years and over	70 years and over	80 years and over
World	3,037.2	249.9	165.3	98.6	19.9	4,432.1	375.8	295.5	158.3	35.3
More-developed regions[1]	944.9	118.6	80.3	50.1	11.7	1,131.3	170.5	127.8	82.3	20.9
Less-developed regions[2]	2,092.3	131.3	85.0	48.5	8.1	3,300.8	205.3	131.7	76.0	14.4
Africa	275.2	13.5	8.3	4.6	0.7	470.0	14.3	14.3	7.9	1.3
East Asia	815.8	61.9	39.3	22.3	3.7	1,174.9	68.2	68.2	40.9	8.2
South Asia	876.5	51.8	35.1	20.4	3.5	1,403.7	43.8	43.8	24.1	4.2
Northern America	198.7	25.8	18.0	11.3	2.7	247.8	26.2	26.2	17.0	4.7
Latin America	215.7	12.2	7.7	4.4	0.9	363.7	15.5	15.5	9.4	2.2
Europe	425.1	61.3	41.3	25.9	6.1	483.7	63.0	63.0	41.2	10.2
U.S.S.R.	214.3	21.6	14.5	9.1	2.1	265.5	26.7	26.7	16.7	4.2
Oceania	15.8	1.7	1.2	0.7	0.2	22.8	1.8	1.8	1.1	0.3
	2000					2020				
	Total population	60 years and over	65 years and over	70 years and over	80 years and over	Total population	60 years and over	65 years and over	70 years and over	80 years and over
World	6,118.9	590.4	402.9	252.5	59.6	7,813.0	975.6	649.2	392.3	101.6
More-developed regions[1]	1,272.2	230.3	166.0	111.7	30.2	1,360.2	296.3	212.4	139.4	43.3
Less-developed regions[2]	4,846.7	360.0	236.9	140.8	29.4	6,452.8	679.2	436.9	263.4	58.2
Africa	852.9	42.7	27.3	15.6	2.8	1,401.6	84.2	54.2	31.9	6.7
East Asia	1,474.7	168.8	116.0	72.3	17.0	1,680.1	295.3	197.6	117.4	30.2
South Asia	2,074.8	133.4	84.2	47.3	8.0	2,688.6	254.3	159.4	91.2	18.7
Northern America	298.8	44.7	33.1	22.9	6.4	336.4	69.7	47.8	29.8	7.7
Latin America	565.7	41.0	27.9	17.5	4.5	803.6	78.2	51.5	31.2	8.2
Europe	512.0	101.6	74.5	50.2	13.6	521.4	122.7	89.6	59.9	18.5
U.S.S.R.	310.2	54.4	37.3	25.2	6.8	346.2	65.4	45.0	28.8	11.2
Oceania	29.7	3.7	2.6	1.8	0.5	35.0	5.8	4.0	2.5	0.6

[1]More-developed regions include Northern America, Japan, Europe, Australia, New Zealand, and Union of Soviet Socialist Republics.
[2]Less-developed regions include Africa, Latin America, China, Other East Asia (excluding Japan), South Asia, Melanesia, and Micronesia-Polynesia.

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

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and Projections as Assessed in 1980, Population Studies, Series A, No. 82.[1]

The countries of the world are generally classified here into the More Developed Regions (MDR) and the Less Developed Regions (LDR), and into eight component regions. The regions classed as LDR by the United Nations include all of Africa, all of Latin America, Asia outside of Japan, the Union of Soviet Socialist Republics, and Oceania outside of Australia and New Zealand. The remainder of the world area is classed as MDR. The countries of any region may differ widely with regard to their level of economic development, social organization, and cultural characteristics and, hence, variations in demographic conditions and prospects from country to country may be substantial.

The older population is a demographically heterogeneous population. This is so partly because it encompasses a wide range of ages showing sharp shifts in the characteristics of the population in the component ages, and partly because of the rapid turnover of the population. At these ages, shifts in basic demographic characteristics (numbers and age distribution, sex composition, survival probabilities) and in socioeconomic status (marital status, labor force status, income status) occur rapidly. Many of the changes are triggered by the event of death and deteriorating health, but the shifts themselves also exert an influence on mortality and health.

BASIC DEMOGRAPHIC TRENDS

Numbers, Proportions, and Age Composition

Number of elderly. At present, more than 376 million people are aged 60 or older in the world (table 1). Included in this figure are 171 million people in the MDR and 205 million in the LDR. The LDR now contain well over half (55 percent) of the world's older population (table 2). The number of persons 60 years and over in the world will increase greatly by the year 2000. According to the U.N. projections, there will be 590 million at that time, with approximately 230 million in the MDR and 360 million in the LDR. About 302 million will be found in Asia alone. By the year 2000, the balance will shift further in favor of the LDR, which will then contain 61 percent of the elderly persons in the world.

The growth rate for the elderly in the world is rising and will continue to rise. In the 1960-1980 period it was 50 percent; it is expected to be 57 percent for the 1980-2000 period and 65 percent for the period 2000-2020 (table 3 and figure 1). A high rate of growth of the elderly is not new but has corresponded, with a lag, to high fertility and the associated increases in the numbers of births, and to increases in longevity. The rise in the world's growth rate of the elderly is a result of the very rapid increase in the LDR growth rate. As expected, on the basis of the trend of births in the twenties and thirties, the MDR growth rate of the elderly shows declines. The growth rate between 1980 and 2000 in the LDR is expected to be much higher than in the MDR (75 percent vs. 35 percent), and the rates will diverge further in the subsequent vicennium (89 percent vs. 29 percent).

Table 2. Percent Distribution of the Population 60 Years and Over by Regions: 1960 to 2020

(Projections are medium variant)

Region	1960	1980	2000	2020
World	100.0	100.0	100.0	100.0
More-developed regions	47.5	45.4	39.0	30.4
Less-developed regions	52.5	54.6	61.0	69.6
Africa	5.4	6.1	7.2	8.6
East Asia	24.8	27.3	28.6	30.3
South Asia	20.7	18.9	22.6	26.1
Northern America	10.3	9.9	7.6	7.1
Latin America	4.9	6.2	6.9	8.0
Europe	24.6	21.7	17.2	12.6
U.S.S.R.	8.6	9.2	9.2	6.7
Oceania	0.7	0.7	0.6	0.6

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

The largest regional increases in the 1980-2000 period will occur in South Asia and Africa: they each will show increases of about 87 percent. The older population of several countries of Asia (e.g., Philippines, Republic of Korea, India, Thailand) will double or nearly double in this period. Table 4 illustrates country-to-country variations in the percent increase of the elderly population with figures for selected countries of Asia.

During the period 1980-2000, the growth rate of the population 60 years and over is expected to exceed that of every other broad age segment in the population and, hence, that of the total population. In the LDR as a whole, the total population will grow 47 percent in the 1980-2000 period as compared with 75 percent for the population 60 years and over. The higher the age band, the faster the growth rate. The population 70 years and over will grow 86 percent and the population 80 years and over, 104 percent. This pattern is characteristic of each less-developed region.

Proportion of elderly. The proportion of older persons is much higher—almost 2-1/2 times higher—in the MDR than in the LDR. In 1980, those over 60 years of age constituted 15.0 percent of the population in the MDR and 6.2 percent of the population in the LDR, averaging to 8.5 percent of the world population (table 5). Current figures range from 5 to 6 percent of the population in the rapidly growing regions of Africa, South Asia, and Latin America to 15 to 17 percent for the more static populations of Europe and Northern America.

All developed regions experienced a rise in the proportion of older persons between 1960 and 1980. The increase was greater in the U.S.S.R. than elsewhere (from 10.1 to 13.2

[1]The projections were prepared by the cohort-component method, that is, by carrying forward a current age-sex distribution on the basis of separate assumptions regarding future fertility, mortality, and net immigration. The base year for these projections is 1975. The United Nations prepared three series of population projections, designated high, medium, and low. The medium variant has been selected as the principal basis for the analysis. The projections imply the general assumption that between 1980 and 2020 there will be no major changes in the organization of medical care and future health, and, in addition, there will be no monumental changes in environmental, social, and economic conditions.

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Table 3. Percent Increase in the Total Population and Older Age Groups: 1960 to 1980, 1980 to 2000, and 2000 to 2020

(Projections are medium variant)

Region	1960 to 1980				1980 to 2000				2000 to 2020			
	Total population	60 years and over	70 years and over	80 years and over	Total population	60 years and over	70 years and over	80 years and over	Total population	60 years and over	70 years and over	80 years and over
World	45.9	50.4	60.5	77.6	38.1	57.1	59.5	68.8	27.7	65.2	55.6	70.4
More-developed regions	19.7	43.8	64.2	78.2	12.4	35.1	35.7	44.5	6.9	28.6	24.8	43.5
Less-developed regions	57.8	56.3	56.7	76.9	46.8	75.4	85.3	104.0	33.1	88.7	79.9	98.1
Africa	70.7	69.7	73.5	75.8	81.5	86.3	97.0	117.7	64.3	97.2	104.0	135.9
East Asia	44.0	65.5	83.1	120.9	25.5	64.7	76.7	107.6	13.9	74.9	62.5	75.8
South Asia	60.2	37.1	18.6	21.4	47.8	87.8	95.0	91.2	29.6	90.6	93.7	132.5
Northern America	24.8	43.9	50.7	72.0	20.6	20.7	34.6	35.9	12.6	55.7	30.4	19.6
Latin America	68.6	91.2	113.1	141.1	55.6	75.7	87.0	106.0	42.0	90.7	78.1	83.7
Europe	13.8	33.0	59.5	68.1	5.9	24.5	21.7	32.9	1.8	20.3	19.3	36.3
U.S.S.R.	23.9	61.0	82.7	103.9	16.9	56.6	51.1	60.7	11.6	20.3	14.6	65.9
Oceania	44.6	53.4	51.3	65.3	30.2	41.5	59.5	64.5	17.8	56.0	43.8	41.0

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

Table 4. Percent Increase in the Population 60 Years and Over in Selected Countries of Asia: 1960 to 1980, 1980 to 2000, and 2000 to 2020

(Projections are medium variant. Countries are ranked by projected percent increase, 1980 to 2000)

Country	Percent increase			Country	Percent increase		
	1960 to 1980	1980 to 2000	2000 to 2020		1960 to 1980	1980 to 2000	2000 to 2020
Philippines	50.5	108.9	128.8	Japan	77.3	78.8	27.3
Republic of Korea	82.6	99.9	90.7	Burma	103.5	74.5	66.8
India	21.2	93.5	85.4	Pakistan	28.7	72.0	109.8
Thailand	51.2	93.0	123.1	Viet Nam	38.8	71.7	78.2
Sri Lanka	68.7	90.9	90.1	Bangladesh	45.7	71.5	107.8
Indonesia	75.5	86.1	72.1	China	62.4	60.9	83.1

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

Table 5. Percent of the Total Population in the Older Ages: 1960 to 2000

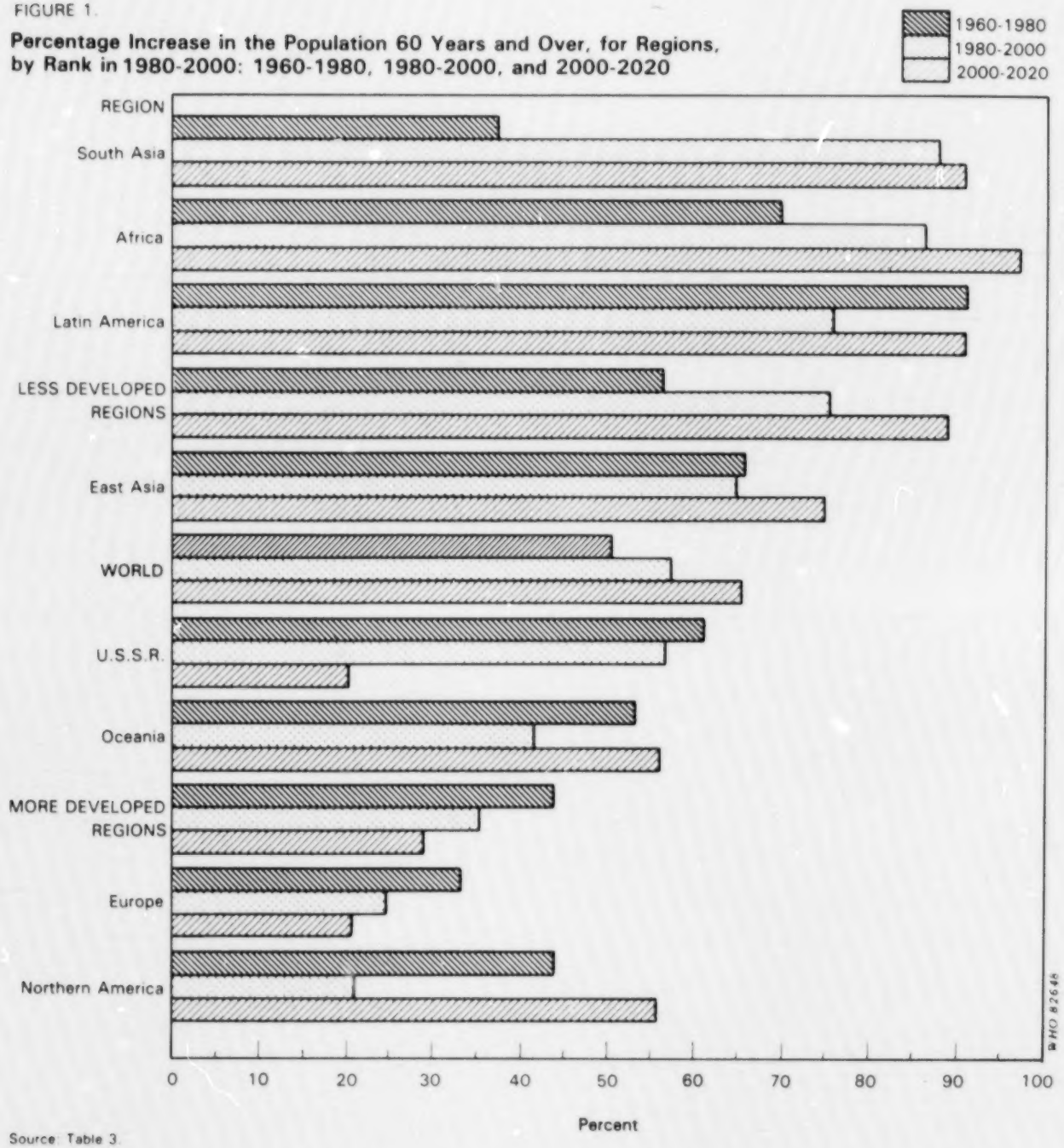
(Projections are medium variant)

Regions	60 years and over				70 years and over			
	1960	1980	2000	2020	1960	1980	2000	2020
World	8.2	8.5	9.6	12.5	3.2	3.6	4.1	5.0
More-developed regions	12.5	15.0	18.1	21.8	5.3	7.3	8.8	10.3
Less-developed regions	6.3	6.2	7.4	10.5	2.3	2.3	2.9	3.9
Africa	4.9	4.9	5.0	6.0	1.7	1.7	1.8	2.3
East Asia	7.6	8.7	11.4	17.6	2.7	3.5	4.9	7.6
South Asia	5.9	5.1	6.4	9.5	2.3	1.7	2.3	3.4
Northern America	13.0	15.0	15.0	20.7	5.7	6.9	7.6	8.9
Latin America	5.6	6.5	7.2	9.7	2.0	2.6	3.1	3.9
Europe	14.4	16.9	19.8	23.5	6.1	8.5	9.8	11.5
U.S.S.R.	10.1	13.1	17.5	18.9	4.3	6.3	8.1	8.3
Oceania	10.8	11.5	12.5	16.5	4.6	4.9	6.0	7.3

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

FIGURE 1.

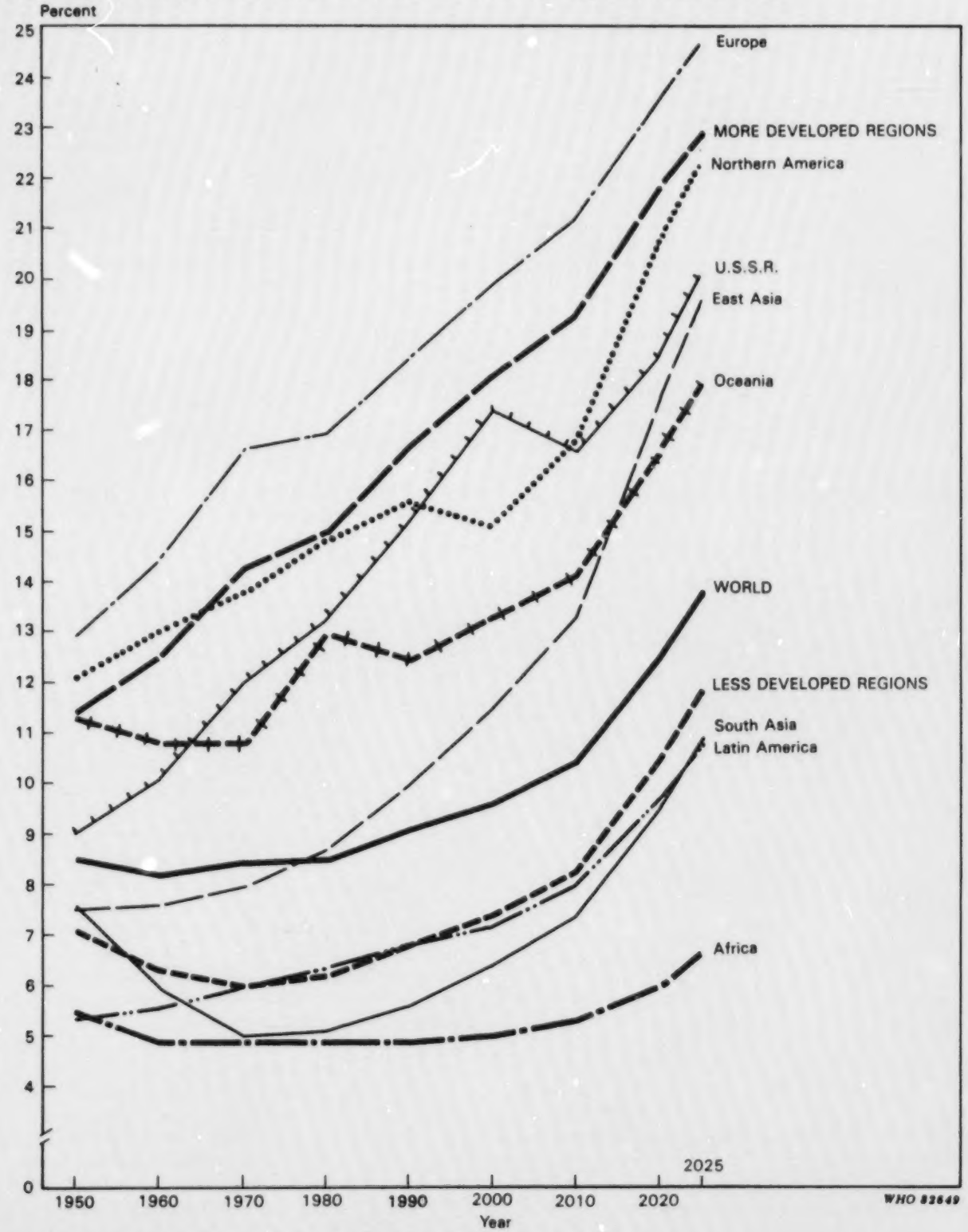
Percentage Increase in the Population 60 Years and Over, for Regions, by Rank in 1980-2000: 1960-1980, 1980-2000, and 2000-2020



Source: Table 3.

FIGURE 2.

Percentage of the Total Population 80 Years and Over, for Regions: 1950 to 2025



Source: Table 5 and United Nations, Population Studies, Series A, No. 82.

percent), but Europe and Northern America also showed substantial rises (table 5 and figure 2). The proportions of older persons in all regions are expected to increase from 1980 to at least the year 2020. Increases to the year 2000 are expected to be slight for some regions (e.g., Northern America, Africa) and substantial in others (e.g., East Asia, Europe, U.S.S.R.). On the whole, the LDR will show the smaller gains because of higher fertility and higher mortality. By the year 2000, nearly 20 percent of the population of Europe will be 60 years or over. The share of the elderly in the first two decades of the next century will rise sharply in most regions of the world, especially in East Asia, South Asia, Northern America, and Europe.

Similar changes are expected to occur in the proportions at the higher ages. By the year 2020, 10 percent of the population of the MDR and 4 percent of the population of the LDR will be 70 or over, as compared with 7 percent and 2 percent, respectively, in 1980. Changes in the proportions at the younger ages for the MDR will follow an opposite path—modest reductions in the "working ages" and among children (table 6). The age restructuring is expected to be very favorable for the LDR—substantial increases in the proportion at the "working ages" and reductions for children.

Table 6. Percent Distribution of the Population by Broad Age Groups for the More-Developed Regions and the Less-Developed Regions: 1980 to 2020

(Projections are medium variant)

Regions	1960	1980	2000	2020
World	100.0	100.0	100.0	100.0
Under 15 years	37.2	35.0	30.7	26.0
15 to 59 years	54.6	56.5	59.7	61.5
60 years and over	8.2	8.5	9.6	12.5
More-developed regions	100.0	100.0	100.0	100.0
Under 15 years	28.6	23.1	21.0	20.0
15 to 59 years	58.9	61.8	60.9	58.2
60 years and over	12.5	15.1	18.1	21.8
Less-developed regions	100.0	100.0	100.0	100.0
Under 15 years	41.1	39.1	33.2	27.3
15 to 59 years	52.6	54.6	59.3	62.1
60 years and over	6.3	6.2	7.4	10.5

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980. Population Studies, Series A, No. 82, United Nations, New York.

Age structure of the older population. There is a greater share of persons at the extreme ages among the elderly in the MDR as compared with the LDR. Nearly one-half (48 percent) of the persons 60 years and over in the MDR are 70 years and over as compared with less than two-fifths (37 percent) in the LDR (table 7). In Europe, the proportion exceeds 50 percent, but it is only a little over one-third (34 to 35 percent) in South Asia and Africa.

In most regions, including more-developed and less-developed regions, the older population has itself been aging; that is, the older segment of the elderly population has been increasing at a faster rate than the younger segment. Between 1960 and 1980 the growth rates for those 70 years and over and those 60 to 69 years of age in the world's population were 60 percent and 44 percent, respectively (table 3). Between 1980 and 2000, however, the difference in growth rates will diminish greatly; the older segment is expected to increase by 60 percent while the younger segment is expected to increase by 55 percent.

A higher proportion of the growth of the older segment (i.e., 70 years and over) will occur in the LDR (two-thirds) than the MDR (one-third), so that the LDR's share of the world's 70-plus population will shift from the smaller share (48 percent) to the larger share (56 percent) in this period. Yet, the proportion over 70 years among those 60 years and over in the MDR in 2000 will continue to exceed the LDR proportion greatly (48 percent vs. 39 percent). One out of two oldsters is expected to be 70 years or over in Europe in 2000, but only a little over one out of three is expected to fall in this age group in South Asia. The projections indicate that the aging of the elderly population will slacken off after the year 2000, especially in Northern America.

Demographic factors affecting changes in numbers and proportion. It is not generally recognized that fertility exercises a very important influence on the changes in the numbers and proportions at each age in a population. The number of births establishes the potential number of persons who will fall in the older ages 60 or more years later, even though mortality reduces these births throughout life and the number of surviving oldsters may be far fewer than the original numbers of births in the cohort. Changes in the numbers of births are generally more determinative of later changes in the number of older persons, especially over a short period of time such as a decade or two, than mortality levels and changes. Furthermore, in general, fertility changes are a much more important factor influencing the age distribution of a population than mortality changes; that is, fertility usually explains much more of the variation in the percent of persons 60 years and over than the level of life expectation. An understanding of past and prospective trends in fertility is essential, therefore, in the analysis of changes in the number of older persons and in the aging of populations. These influences of fertility on age changes are explored further in later sections.

The number of persons 60 years and over is determined largely by the number of births 60 to 80 years before the estimate date and the level of the survival rate from birth to this older age band. Because of past general rises in the numbers of births and in survival rates in most countries, the numbers of elderly persons have been rising rapidly. In the LDR, the prevalence of high, roughly constant, or even increasing growth rates resulted in steady increases in the annual numbers of births as the population bases grew larger.

It is important to recognize that the elderly persons of the future (at least for 60 years ahead) have already been born. It is possible to track the future impact of these birth cohorts on the size of the older population long before they reach age 60. For example, the large birth cohorts of 1945-1964 (post-World War II baby boom) experienced by most developed countries will, under prevailing survival conditions, have a major impact on changes in the numbers of elderly persons

Table 7. Percent 70 Years and Over and 80 Years and Over of the Population 60 Years and Over: 1960 to 2020

(Projections are medium variant)

Region	Percent of population 60 years and over							
	1960		1980		2000		2020	
	70 years and over	80 years and over	70 years and over	80 years and over	70 years and over	80 years and over	70 years and over	80 years and over
World	39.5	8.0	42.1	9.4	42.8	10.1	40.3	10.4
More-developed regions	42.3	9.9	48.3	12.3	48.5	13.1	47.0	14.6
Less-developed regions	36.9	6.2	37.0	7.0	39.1	8.2	37.3	8.6
Africa	33.8	5.5	34.6	5.7	36.6	6.6	37.9	7.9
East Asia	36.1	6.0	39.9	8.0	42.8	10.1	39.8	10.1
South Asia	39.3	6.7	34.0	5.9	35.3	6.0	35.8	7.3
Northern America	43.7	10.7	45.8	12.8	51.1	14.4	42.8	11.0
Europe	36.1	7.4	40.2	9.3	42.8	10.9	39.9	10.5
Latin America	42.1	9.9	50.6	12.5	49.4	13.4	48.8	15.1
U.S.S.R.	42.3	9.4	48.0	12.1	46.3	12.4	44.1	17.2
Oceania	43.0	9.8	42.4	10.6	47.8	12.3	44.0	11.1

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

in the early part of the next century. If mortality conditions continue to improve, then the older population will swell to even greater numbers than will be accounted for by the rise in birth cohorts (Myers, 1978). In fact, past population projections have tended to underestimate mortality decline, even for countries in which procedures of population projection have been highly developed, such as the United States (Siegel, 1979).

Changes in the number of elderly persons over a decade or two are largely determined by variations in the size of past birth cohorts. For example, the sharp increase in the numbers of persons 60 years and over expected in the LDR between 1980 and 2000 (75 percent) results from the rapid rise in the number of births 40 to 80 years ago associated with continuing high fertility rates. Declines in death rates tend to have a secondary effect on such changes unless the declines in the 20 years separating the two birth cohorts are pronounced in comparison to the change in the size of the birth cohorts. Mortality is likely to have a greater effect on changes in the older population when fertility in the appropriate prior years and subsequent mortality are very low.

The age structure of a population is determined primarily by the birth and death rates that have been characteristic of that population during the lifetime of its members (Coale, 1972). There has been considerable theoretical and empirical research demonstrating that fertility changes are a much more important factor in the aging of populations than mortality changes. That is, populations with high fertility will tend to have a low proportion of older persons, and vice versa (figure 3), and changes in fertility generally have a greater effect on the proportion of the elderly in the population than do changes in mortality. Projections of changes in the proportions in the age group 60 years and over reflect primarily past trends in fertility, in particular changes in the numbers of births 60 or more years earlier, and the assumptions made about future gross reproduction rates (the number of female children a woman will have in her lifetime). A projected decrease in the gross reproduction rate tends in itself to reduce the proportion of young people and increase the proportion of old people.

Decreases in mortality tend to contribute relatively little to increases in the proportion of elderly persons compared to decreases in fertility, and may in fact contribute to decreases in the proportion of elderly persons (Coale, 1956; Parant, 1978; Siegel, 1979). The effect of decreases in age-specific death rates on age structure depends upon the ages at which such decreases occur. If the decreases are the "same" at all ages (or, more precisely, if the relative changes in survival rates are the same at all ages), the age structure of the population will tend to remain the same. If death rates are high and decrease mainly at the younger ages, as has occurred generally in the past in the MDR and more recently in the LDR, children and young people will initially tend to increase and the proportion of old people will tend to initially decrease. (This tendency has been typically offset in the MDR by rising numbers of births in the distant past and falling fertility). If, however, the declines in death rates occur mainly at the older ages, as is expected to occur in the countries of low fertility and low mortality (i.e., the countries of the MDR) in future years, the proportion of older persons will tend to increase.

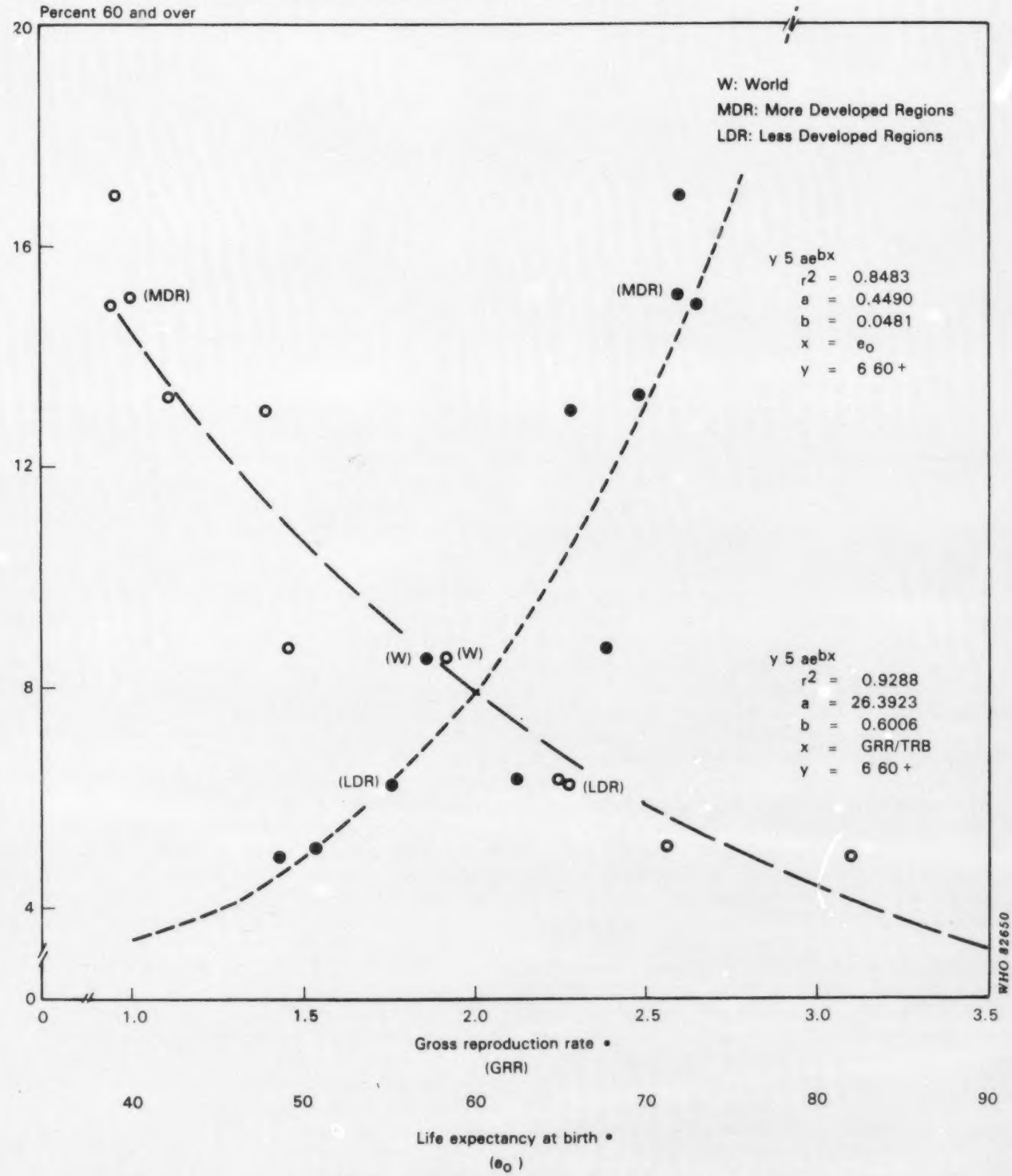
According to theoretical models of population structure, the percent of persons 60 years and over tends to rise as the gross reproduction rate falls.[2] The proportion tends to rise even if life expectation does not change. A rise in the percent of persons 60 years and over is associated with a rise in life expectation only at the lower levels of the gross reproduction rate and at the higher levels of life expectancy. The effect on the proportion of persons 60 years and over is pronounced when the gross reproduction rate is below 2.0 and life expectation exceeds 70 years. Immigration can affect these relationships but usually its effect is relatively small.

According to the theory of the "demographic transition," the population of countries passes through various stages which represent a shift from high fertility/high mortality to low fertility/low mortality and from a low proportion of elderly

[2]The gross reproduction rate is the total number of girl babies a women will have in her lifetime, on the average, without any allowance for deaths of mothers or children in reaching the childbearing ages.

FIGURE 3.

Relation of the Percentage of the Total Population 60 Years Old and Over to the Gross Reproduction Rate and Life Expectancy at Birth, 1975-1980, for Regions



Source: Based on tables 5 and 8.

to a high proportion of elderly. When a country is in the first stage of the demographic transition, high fertility and high mortality coexist, mortality is concentrated in early life, and a very large proportion of the population is young. As a country enters the second stage of the demographic transition, mortality falls, the growth rate rises, and the proportion in the younger ages increases. In the third stage of demographic transition, fertility declines, the proportion in the younger ages drops, and the proportions in the principal working ages and the older ages increase. Mortality continues to fall and, if the mortality declines are general throughout the age scale and include substantial declines at the older ages, mortality will contribute further to the rise in the proportion of elderly persons.

All of the more-developed regions have passed through the demographic transition. They have all also shown declines in fertility rates since 1950-1955 (table 8). Some of the less-developed countries, including China, have also begun to show fertility declines, even though high levels of fertility continue to prevail in most of them, especially those with the lowest per capita income and economic development. The gross reproduction rates of Africa, South Asia, and Latin America were all still above 2.00 in 1975-1980, with the rate for Africa being substantially above 3.00.[3] Europe's figure was only 0.96. The most rapid decline between 1950-1955 and 1975-1980 occurred in East Asia, where the gross reproduction rate fell by more than 45 percent to 1.46 in 1975-1980.

Will the LDR succeed soon in moving into the final phase of the demographic transition in which high fertility and declining mortality give way to low fertility and low mortality? The projections of fertility employed by the United Nations in its latest population projections imply that such a shift will occur. Declines in fertility are expected to come about through the combined effect of the wider adoption of Western birth control technology, the extension of family planning programs, and the influences of modernization and socioeconomic development. According to the UN projections, by the year 2000, the gap between fertility in the less-developed regions and the more-developed regions will be sharply reduced as compared with 1975-1980, even though gross reproduction rates would still be high (over 1.5) in South Asia, Latin America, and Africa. Africa's figure would still exceed 2.5. By the year 2025, gross reproduction rates in all regions except Africa would be substantially below 1.5, the projected figure for Africa.

In the MDR, declining or low fertility and mortality are giving rise to age distributions which are approaching stationarity.[4] These countries tend to have a gross reproduction rate below 1.00 and a life expectancy at birth of 70-75 years. Stationary populations with low levels of mortality inevitably have large proportions of elderly. A typical population with a life expectancy at birth of 74 years that is stationary has 23 percent of its total above age 60 and 17 percent of its total above age 65. Stationarity has nearly been reached in Western Europe with some 20 percent of the total now over age 60 and about 14.5 percent over age 65. In less than another "generation," the developed regions in general will have achieved a stationary condition.

Turnover of elderly population. A special demographic feature of the elderly population is its high rate of turnover; that is, the identity of the members of the group shifts greatly in short periods of time. The turnover rate for this group is far higher than for any other broad age group in the population. Turnover for the older population results mainly from the entry of new cohorts, as for all age groups, and the

[3]A gross reproduction rate of only 1.03 to 1.10 is required for population replacement.

[4]A stationary population is one with a growth rate of zero and unchanging numbers in each age group. It is a theoretical condition since, in reality, no population would continue over any substantial period of time to have a zero growth rate in total and at each age.

Table 8. Gross Reproduction Rates and Life Expectancy: 1950-1955 and 2020-2025

(Projections are medium variant)

Region	Gross reproduction rate				Life expectancy at birth				Life expectancy at age 60, 1975-1980[1]
	1950 to 1955	1975 to 1980	1985 to 2000	2020 to 2025	1950 to 1955	1975 to 1980	1985 to 2000	2020 to 2025	
World	2.41	1.92	1.46	1.15	47.0	57.5	63.9	70.4	15.3
More-developed regions	1.38	1.00	1.00	1.04	65.2	71.9	73.7	75.4	18.5
Less-developed regions	2.98	2.27	1.58	1.17	42.4	55.1	62.5	69.6	14.9
Africa	3.15	3.13	2.64	1.49	37.3	48.6	57.8	67.2	14.1
East Asia	2.61	1.46	0.96	0.96	47.5	67.6	72.7	74.8	16.9
South Asia	3.10	2.57	1.63	1.05	39.4	50.6	59.5	68.6	14.3
Northern America	1.69	0.94	1.01	1.02	69.0	73.0	74.1	75.1	18.8
Latin America	2.86	2.24	1.64	1.35	51.2	62.5	68.1	71.8	16.1
Europe	1.26	0.96	0.91	1.02	65.4	72.0	74.3	75.7	18.3
U.S.S.R.	1.38	1.16	1.14	1.10	61.7	69.6	71.5	74.6	18.2
Oceania	1.86	1.39	1.22	1.10	60.7	65.6	70.2	73.8	16.6

[1]Estimated on the basis of expectation of life at birth for each sex and Coale-Demeny model life tables ("West" region).

Source: United Nations, World Population Prospects as Assessed in 1980, Population Studies, No. 78, United Nations, New York, 1981, tables 4 and 5.

rapid departure of a substantial segment of the original members through death. For example, according to recent estimates of mortality for the world's population, after the 10-year period ending in 1980, only 51 percent of the initial population 60 years and over in 1970 remained (table 9). The turnover of the elderly population was greater for the LDR than for the MDR (48 percent surviving vs. 55 percent surviving), as expected on the basis of differences in levels of mortality.

The older population, characteristically heterogeneous in its composition because of the wide range of ages included, is rendered even more heterogeneous by the rapid turnover of members. This turnover involves a replacement of the large body of decedents, having one set of characteristics, with younger persons entering the group who are likely to have quite different characteristics. The demographic heterogeneity and high turnover of the older population require that society's responses to its needs be sufficiently multi-faceted and flexible to enable it to deal effectively with the many different age categories of the older population, its varied characteristics, and the often pronounced changes in these characteristics.

Some implications for health needs. Various research studies show that the health needs of older persons, both those fulfilled and those unmet, are greater than those of other age segments of the population, as is their utilization of health services (U.S. Public Service 1978). Moreover, the need for health services will grow because of the expected growth of the older population. This is particularly important in the LDR, where an especially larger growth of the older population can be expected and where resources are limited for supporting health services for older persons. Because of the large numbers involved and their rapid growth, the need to plan for the level and types of services required by older persons must become of special concern to health planners in these areas. The increase in need for health services is intensified by the growth in the proportion of older people in the population and by the aging of the older population itself, that is, the growing proportion of older persons who are of extreme age. Persons of extreme age are particularly subject to chronic, debilitating diseases and severe disability, and are more likely to need prolonged health care. It can be expected, therefore, that the number of persons with a chronic debilitating disease or a severe disability will increase. This situation is especially likely to characterize the countries of the LDR, where postponement of the onset of chronic illness or mitigation of its more severe functional consequences is less likely to occur.

Given current information on the level of health services, it is possible to calculate what increases in the number of physicians, nurses, dentists, and hospital beds will be needed to maintain or to improve upon the current level of services. We simply need to multiply the current ratio of health personnel or facilities to population, preferably for each age-sex group, by the projected population to determine the number of personnel or facilities needed to maintain the current level of services; the numbers corresponding to an improved level of services can be worked out by use of higher ratios. An illustration of the implications of population growth to the year 2000 for health resources requirements (health personnel, beds) has been given for the countries of South and East Asia by Hansluwka and his associates (Hansluwka, Lopez, and Ruzicka, 1980). For example, India, which had about 154,000 physicians and about 473,200 beds in 1975 will need at least 259,200 physicians and 808,600 beds in 2000 to maintain the same level of services as in 1975 (table 10). If, however, India is to reach the level of health services of Sri Lanka in 1975, it will require 829,000 physicians and 3.1 million beds in 2000.

Table 9. Census Survival Ratios by Decades: 1970 to 1980, 1980 to 1990, and 1990 to 2000

(Projections are medium variant)

Region	1970 to 1980	1990 to 2000	1990 to 2000
	70 years and over in 1980	70 years and over in 1990	70 years and over in 2000
	60 years and over in 1970	60 years and over in 1980	60 years and over in 1990
World	51.2	51.2	53.2
More-developed regions	55.0	53.3	55.3
Less-developed regions	47.7	50.1	51.6
Africa	45.2	47.8	50.4
East Asia	51.5	53.3	54.3
South Asia	42.9	46.1	48.5
Northern America	54.3	53.6	53.7
Latin America	54.8	55.1	55.8
Europe	53.9	51.7	54.5
U.S.S.R.	57.6	54.6	56.9
Oceania	53.2	54.1	54.3

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

Table 10. Health Personnel and Beds Required in the Year 2000 for Selected Countries of South Asia, Based on Assumed Population/Health Personnel and Population/Bed Ratios

Country	Physicians			Dentists			Nurses			Beds		
		Required in 2000			Required in 2000			Required in 2000			Required in 2000	
	Around 1975	1975 ratio[1]	S.L. ratio[2]	Around 1975	1975 ratio[1]	S.L. ratio[2]	Around 1975	1975 ratio[1]	S.L. ratio[2]	Around 1975	1975 ratio[1]	S.L. ratio[2]
Bangladesh	6,500	12,300	38,300	100	200	3,200	1,700	3,400	76,700	18,400	35,300	643,000
India	154,000	259,200	829,000	9,400	15,600	21,800	113,500	197,000	518,300	473,200	808,600	3,130,700
Indonesia	9,000	15,500	55,400	2,100	3,300	4,700	45,000	68,700	110,800	82,900	133,000	669,300
Nepal	350	700	5,600	20	30	470	250	430	11,200	2,100	3,600	67,700

[1]Number required on basis of population/health-practitioner ratio or population/bed ratio in 1975 of particular country.
[2]Number required to attain the 1975 level-of-service ratios in Sri Lanka by 2000.

Source: World Health Organization, "Some Implications of Demographic Prospects for Health Care in Countries of South and East Asia," by Harald Hansluwka, Alan Lopez, and Lado Ruzicka in WHO/ESCAP Meeting on Mortality in Asia: A Review of Changing Trends and Patterns, 1950–1975, Manila, December 1-5, 1980.

Table 11. Males per 100 Females for the Population 60 Years and Over and 70 Years and Over: 1960 to 2020

(Projections are medium variant)

Region	60 years and over				70 years and over			
	1960	1980	2000	2020	1960	1980	2000	2020
World	81.9	79.8	84.4	86.3	75.8	70.6	74.3	76.7
More-developed regions	70.5	65.9	72.3	78.1	65.5	58.4	60.3	67.3
Less-developed regions	93.6	93.3	93.1	90.9	89.2	86.0	87.4	84.3
Africa	82.5	84.4	85.1	87.0	77.9	78.6	80.0	80.5
East Asia	88.2	89.7	93.5	89.5	80.3	81.4	84.7	83.3
South Asia	102.7	98.7	94.1	93.4	100.4	93.2	90.7	85.7
Northern America	85.9	75.3	73.5	77.4	80.5	64.9	64.6	65.1
Latin America	90.0	90.0	88.7	88.8	83.2	84.9	83.5	82.7
Europe	71.6	70.1	76.3	81.2	65.9	62.4	64.7	71.4
U.S.S.R.	48.6	44.8	60.1	70.3	43.7	39.5	44.5	56.2
Oceania	83.2	82.9	85.7	86.1	76.4	71.1	76.4	77.2

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Populations as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

For the vast majority of countries where the present supply of health personnel and facilities is grossly inadequate, health services will be diluted even further as a result of population growth unless a determined effort is made to keep pace with prospective population changes. In India, for example, unless there is a substantial increase in health personel and facilities, coverage of the population by physicians in 2000 could be less than three-quarters the level of 1975. The investment that will be needed to improve health care services is enormous, and even to maintain the current level of services will require a major increase in health care expenditures. The declines in fertility anticipated in the less-developed regions would result in a reduction of the growth rate of the population and thereby introduce the possibility for increased investment and economic development. They would also contribute, however, to a rise in the proportion of elderly persons in the population and thereby contribute to an increase in the share of services required for this age segment.

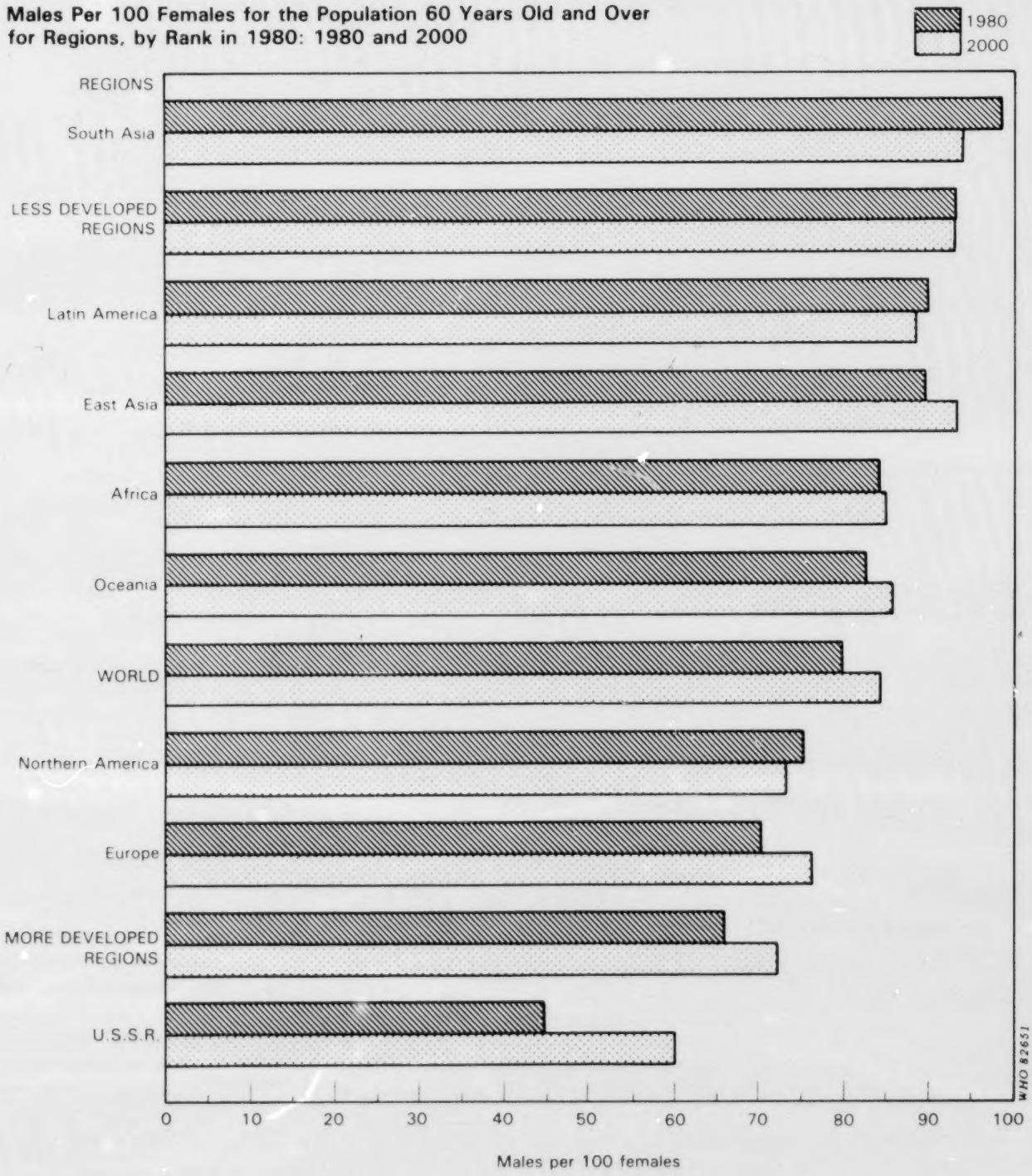
Analysis of the way in which population stationarity affects the social and economic conditions of older persons and the societies in which they live has only recently been undertaken on an intensive scale (Spangler, 1978; Espenshade and Serow, 1978; Schwarz, 1977; and Serow, 1981). The concentration of persons in the ages where chronic health problems are most common and the decline in the ratios of workers to older dependents, with its possible consequences for the supply of health workers and the funding of health and social services, need careful analysis. What stationarity with low mortality will signify for a population's health is necessarily conjectural at this time. Since there will be more old people, it is likely that chronic disabilities and ailments will be more prevalent. The effective degree of prevalence and severity of the conditions are uncertain since this will depend on life styles, technological developments, and social acceptability of old age as well as on medical developments and health care delivery procedures (Day, 1978; Gendell, 1980).

Balance of the Sexes

Past and prospective trends. Women greatly outnumber men at ages 60 and over in both the LDR and the MDR; the excess of women in the MDR is, in fact, considerable. In 1980, the sex ratios (i.e., the number of males per 100 females) were 93 and 66, respectively (table 11 and figure 4). The sex ratio of the world's older population, 80, is about midway between the figure for the MDR and the figure for the LDR, in spite of the fact that three-quarters of the world's population lives in the LDR. The effect of the latter factor on

FIGURE 4.

Males Per 100 Females for the Population 60 Years Old and Over for Regions, by Rank in 1980: 1980 and 2000



Source: Table 11.

the world's sex balance is offset by the effect of the larger proportion of older persons in the population of the MDR (15 percent) than in the population of the LDR (6 percent). The sex ratios for the total (i.e., all ages) populations of the LDR and MDR are much more balanced and closer to one another (103 and 94) than those for the older population.

By the year 2000, the difference in the sex ratios at ages 60 and over for the LDR and the MDR is expected to diminish as a result of a rise in the sex ratio for the MDR. The projected figures are 93 and 72, respectively. Sharp declines are expected to occur in some less-developed areas that now have relatively high sex ratios (e.g., South Asia, especially Pakistan, India, Bangladesh, and the Philippines), while sharp rises are expected to occur in East Asia, Europe, and the U.S.S.R. The 1980-2000 trends are generally expected to continue to 2020 so that the sex ratios in the MDR and the LDR will become even more similar. The most notable changes are the decline in East Asia and the rises in Northern America, Europe, and the U.S.S.R. The rise in the sex ratio of the U.S.S.R. between 1980 and 2020 will be no less than spectacular, from 45 to 70.

All regions show pronounced drops in the sex balance "between" ages 60 and over and ages 70 and over. In 1980, the sex ratio for the older group was 58 for the MDR and 86 for the LDR, both 7-1/2 points lower than for ages 60 and over. In some less-developed regions the balance of the sexes for the older group was very heavily tilted toward females; the sex ratio was 79 for Africa and 81 for East Asia, for example.

A greater proportion of all females falls in the older ages than males in every region (table 12). This difference is more pronounced for the MDR than the LDR. One out of four females in Europe is over 60 years as compared with one out of seven males; in South Asia there is only a trivial difference in the proportions. This difference between the sexes tends to increase in relative terms with advancing age, even though the percentages are smaller.

Demographic factors affecting sex composition. In most areas of the world, male death rates consistently exceed female death rates at every age (table 13) and, as a result, the initial surplus of boys among newborn children is steadily reduced from birth to old age for the cohort. According to the population estimates for 1980, the numbers of males and females reach a balance by age 35 in the MDR and by age 60 in the LDR. Extremely high sex ratios at the older ages, as in Bangladesh (107), India (108), and Pakistan (113), tend to result where female death rates exceed male death rates at some or all younger ages, and extremely low ratios, as in the U.S.S.R.(45), occur where the male population has been depleted through high rates of war-caused mortality.

Declines in population sex ratios at particular ages over time result generally from the continuing divergence of male and female death rates (i.e., an increase in the excess of male mortality over female mortality) at the given ages and all younger ages for the particular age cohorts in question.

For example, in the U.N. projections of mortality, an assumption of further reductions in death rates for the LDR was combined, for many countries, with an assumption of more rapid declines in female mortality than in male mortality. This assumption parallels the experience of Western countries that have moved from high to low mortality. Progress toward lower mortality has been accompanied in the MDR by a fairly steady divergence of male and female death rates. The projected rise in the population sex ratios of Europe and the U.S.S.R. for ages 60 and over reflect the replacement of the birth cohorts depleted in World War II (i.e., cohorts born after 1920) by postwar cohorts (i.e., cohorts born after 1940).

The generally higher birth rate of the male population (male births per 1,000 male population) than the female popuation (female births per 1,000 female population), which is associated with a sex ratio of births above 1.00, is more than offset at the older ages by the generally higher death rates

Table 12. Percent of the Male and Female Populations in the Older Ages: 1980 and 2020

(Projections are medium variant)

Region	60 years and over				70 years and over			
	1980		2020		1980		2020	
	Male	Female	Male	Female	Male	Female	Male	Female
World	7.5	9.5	11.6	13.6	2.9	4.2	4.4	5.7
More-developed regions	12.4	17.6	19.5	24.1	5.5	8.9	8.4	12.1
Less-developed regions	5.9	6.5	9.9	11.1	2.1	2.5	3.6	4.3
Africa	4.5	5.3	5.6	6.4	1.5	1.9	2.0	2.5
East Asia	8.1	9.4	16.6	18.6	3.1	3.9	6.3	7.6
South Asia	4.9	5.2	9.0	10.0	1.6	1.8	3.1	3.7
Northern America	13.1	16.7	18.5	23.0	5.5	8.1	7.2	10.5
Latin America	6.1	6.8	9.1	10.3	2.4	2.8	3.5	4.3
Europe	14.2	19.4	21.3	25.7	6.7	10.3	9.7	13.2
U.S.S.R.	8.7	17.0	16.0	21.6	3.8	8.4	6.2	10.4
Oceania	10.3	11.0	15.2	17.8	4.0	5.7	6.3	8.2

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections As Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

Table 13. Life Expectation at Birth, 1975 to 1980 and 1995 to 2000, and at Age 60, 1975 to 1980, for Males and Females

Region	At birth						At age 60		
	1975 to 1980[a]			1995 to 2000[a]			1975 to 1980[b]		
	Male	Female	Difference[1]	Male	Female	Difference[1]	Male	Female	Difference[1]
World	56.3	58.8	2.5	62.5	65.5	3.1	14.5	16.0	1.4
More-developed regions	68.4	75.7	7.3	70.2	77.5	7.3	16.5	19.7	3.2
Less-developed regions	54.2	56.0	1.8	61.2	63.7	2.5	14.2	15.6	1.3
Africa	47.1	50.1	3.0	56.1	59.5	3.4	13.4	14.7	1.4
East Asia	66.2	69.1	2.9	70.7	74.8	4.1	16.0	17.7	1.7
South Asia	50.5	50.8	0.3	59.0	59.9	0.9	13.8	14.8	1.1
Northern America	69.2	77.0	7.8	70.1	78.2	8.1	16.8	20.3	3.5
Latin America	60.5	64.5	4.0	65.9	70.4	4.5	15.1	16.9	1.8
Europe	68.9	75.2	6.3	71.3	77.4	6.1	16.7	19.5	2.9
U.S.S.R.	65.0	74.3	9.3	76.0	76.0	8.9	15.8	19.2	3.4
Oceania	63.7	67.7	4.0	72.4	72.4	4.2	15.6	17.5	1.9

[1]Excess of female value over male value.

Source: [a]United Nations, World Population Prospects as Assessed in 1980, Population Studies, Series A, No. 78, New York, 1981.
[b]Estimated from data on life expectation at birth and Coale-Demeny model life tables ("West" region).

Table 14. Societal Age-Dependency Ratios: 1960 to 2020

Region	Total dependency[1]				Aged dependency[2]				Child dependency[3]			
	1960	1980	2000	2020	1960	1980	2000	2020	1960	1980	2000	2020
World	83.2	77.0	67.6	62.7	15.1	15.0	16.2	20.3	68.1	62.0	51.4	42.4
More-developed regions	69.8	61.7	64.2	71.7	21.3	24.4	29.7	37.4	48.5	37.3	34.4	34.3
Less-developed regions	90.0	83.0	68.5	60.9	11.9	11.4	12.5	16.9	78.0	71.6	56.0	44.0
Africa	93.3	99.0	95.7	74.5	9.5	9.7	9.9	10.5	83.8	89.3	85.9	64.0
East Asia	84.1	70.7	55.1	59.3	14.0	14.9	17.8	28.0	70.1	55.8	37.3	31.3
South Asia	90.6	85.8	68.0	54.4	11.3	9.4	10.8	14.5	79.4	76.4	57.2	39.9
Northern America	79.3	61.1	58.6	70.3	23.2	24.1	23.7	35.3	56.1	37.0	34.9	35.1
Latin America	92.9	85.9	72.1	65.9	10.9	11.9	12.5	16.1	82.0	74.0	59.7	49.8
Europe	67.3	64.3	64.3	72.2	24.1	27.7	32.6	40.5	43.2	36.6	31.7	31.7
U.S.S.R.	68.8	59.8	70.3	70.5	17.0	20.9	29.8	32.2	51.8	38.9	40.4	38.3
Oceania	77.7	69.4	63.0	66.0	19.2	19.4	20.3	27.4	58.5	49.9	42.7	38.6

[1] $\frac{\text{Population under 15 years and population 60 and over}}{\text{Population 15 to 59 years}} \times 100$

[2] $\frac{\text{Population 60 and over}}{\text{Population 15 to 59 years}} \times 100$

[3] $\frac{\text{Population under 15 years}}{\text{Population 15 to 59 years}} \times 100$

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

of males than females at each age of life. These differences between the sexes are greater in the MDR than the LDR. The sex ratio at birth, the excess of the male birth rate over the female birth rate,and the excess of male death rates over female death rates are greater in the MDR than in the LDR.

Implications of sex imbalance. Since the male/female imbalance at the older ages in all of the more-developed countries and most of the less-developed countries results principally from premature death of men, usually husbands and fathers, it is typically associated with widowhood, one-parent (female-headed) or one-person (female) households, reduced income and increased poverty of older women, and greater risks of ill health and institutionalization of women. Because most older persons are females in both the MDR and the LDR, especially above age 70, the health problems of the elderly are largely the health problems of older women and special attention should be given to the particular health conditions and health service needs of older women.

On the other hand, since the imbalance is caused primarily by premature death of men, attention needs to be given particularly to the health conditions and health needs of middle-aged men, with emphasis on preventive health programs. In view of the many untoward consequences of the male/female imbalance at the older ages, these efforts at "unequal" treatment of the sexes would be justifiable since they could benefit both sexes indirectly in the long run.

Societal Age-Dependency Patterns

Health planning, social security planning, and other types of planning for the elderly will be affected by population trends for age groups other than those over age 60 since younger groups produce most of the resources needed to support the elderly or compete with them for the available resources. We are concerned then with the relative numbers of elderly persons and persons in other age groups.

The effect of expected changes in the age structure on the support burden placed on workers is suggested by the prospective trends of age-dependency ratios; these represent the ratio of older persons and children to persons of "working age." Age-dependency ratios will generally decline in the LDR, but in most of these areas a structural shift from child dependency to old-age dependency is occurring and will continue to occur; that is, older people will constitute an increasing part of the total burden on persons of working age.

Aged-dependency ratios, defined here as the ratio of persons 60 years and over to persons 15 to 59 years, provide an indication of the contribution of age structure to the problem of the economic dependency of the elderly (Shryock, Siegel, and Associates, 1980). An examination of aged-dependency ratios for various countries and regions offers insight on the international variation in the burden on the working population of supporting the elderly population. The aged-dependency ratio is currently far higher in the MDR than the LDR; there were 24.4 persons 60 years and over per 100 persons 15 to 59 years in the MDR in 1980 compared with 11.4 in the LDR (table 14 and figure 5). For the MDR, a more appropriate choice of ages for computing aged-dependency ratios is 65 years and over and 18 to 64 years because of effective differences in economic activity ratios at various ages between the MDR and the LDR. Such a measure is nearly three times higher for the MDR than for the LDR (17.1 to 6.1); and the MDR figure of 17.1 may be more usefully compared with the earlier LDR figure of 11.4 in evaluating the relative dependency burden of the two populations.

The rising numbers of elderly persons and the decrease in fertility rates anticipated for the future, in both the LDR and the MDR will be reflected in higher aged-dependency ratios (ages 60 and over). The MDR figure is expected to rise to about 29.7 and the LDR figure to approximately 12.5 in the year 2000. Increases will be rather small in Africa and Latin America, but large in East Asia and, especially, the U.S.S.R. A marked rise in the dependency burden of the elderly will occur in nearly every region after 2000, especially East Asia, Northern America, and Europe, as the much larger birth cohorts born after 1940 enter this age group and survival rates continue to rise. Increases of less than 3 older persons per 100 persons of working age are anticipated only in Africa and the U.S.S.R. between 2000 and 2020.

The support burden on the working-age population is affected by two other characteristics of the age distribution: the proportion of children and the shifts in the age composition of the older population. The total-dependency ratio may be viewed as a better measure of the support burden than the aged-dependency ratio since it takes account of the numbers of children as well as the numbers of elderly persons (Cowgill, 1979). One of the factors affecting familial and communal financial support for the elderly in the LDR is the tremendous burden of support of children, who make up a large proportion (e.g., 40 to 45 percent except in East Asia) of the total population in these countries (table 6). In the MDR, the much smaller proportion of children in the total population (e.g., under 30 percent) and the general support of children by their families permit a larger share of communal financial resources to be applied to the sizable older population. Public resources earmarked for the support of children, such as resources for the construction of educational facilities, rarely benefit other members of the society directly, whereas resources channeled into public roads, transportation facilities, and health care programs benefit persons of all ages.

The number of children in the family affects the amount of disposable income available to the family for the use of its other members, including the elderly members. Moreover, the size of the child population in a country or other political unit determines, in part, the amount of public funds available to support the elderly population in the area. Even if account is taken of the fact that care of both the elderly and children is largely a family matter in the LDR, it is clear that support of a large child population is an important limiting factor in the availability of funds for programs benefiting the elderly in the LDR.

The regional variation in the total dependency burden is much less than shown by the aged-dependency ratio since the level of child dependency varies inversely with the level of aged dependency (table 14 and figure 5). Moreover, the total-dependency ratio is dominated by the child-dependency ratio. The ratio of persons under 15 years and over 60 years to 100 persons 15 to 59 years was 83 for the LDR and 62 for the MDR. In 1980, these figures indicate a far different relative dependency situation than do the aged-dependency ratios considered alone.

Between 1980 and 2000, the relative level of the aged-dependency ratios for the LDR and MDR is expected to rise moderately and the relative level of the child-dependency ratios to fall sharply, so that a sharp convergence is expected to occur between the total-dependency ratios for the LDR and the MDR. The relative total burden for the LDR and the MDR will drop from a 35-percent excess for the LDR in 1980 to only about a 7-percent excess in the year 2000. This shift occurs primarily because the assumed decline in fertility in the LDR more than offsets the expected rise in the number of elderly persons in these countries. A continuation of such projected changes will result in a much higher total-dependency ratio in the MDR than in the LDR by 2020.

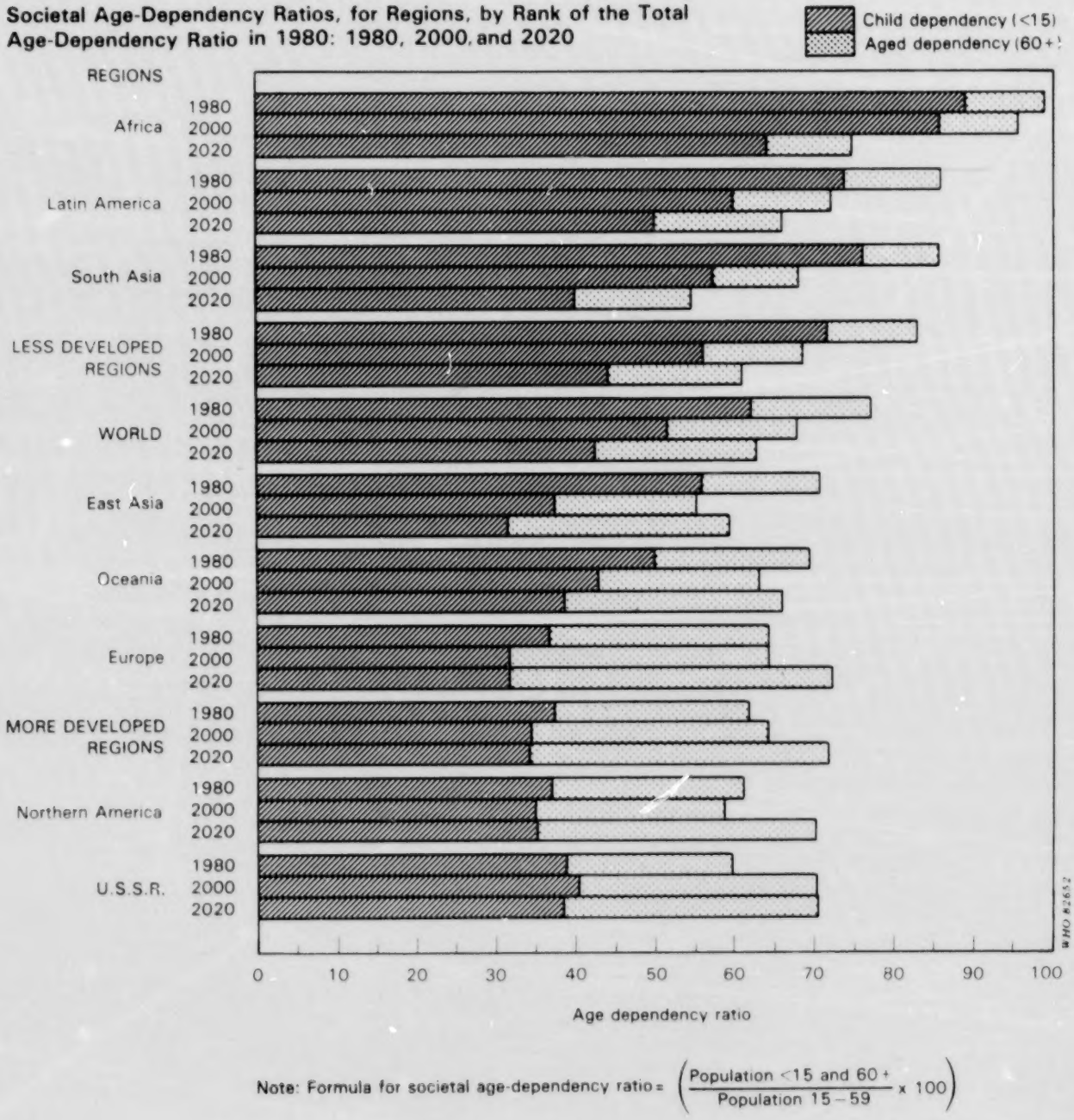
The rise in the support burden of the elderly will be greater than appears from the modest increases shown by the aged-dependency ratio. This is because the very old, who tend to have multiple dependency needs, will constitute a larger part of the total elderly in 2000 than in 1980, as was mentioned earlier. As a consequence, the resources required to contend with the "age-adjusted" aged-dependency burden will be larger than suggested by the "crude" aged-dependency burden.

Population Distribution

Urban and Rural patterns. The rapid growth of cities, especially in the LDR, has been a significant feature of world population trends during the past quarter century. The

FIGURE 5.

Societal Age-Dependency Ratios, for Regions, by Rank of the Total Age-Dependency Ratio in 1980: 1980, 2000, and 2020



Note: Formula for societal age-dependency ratio = $\left(\frac{\text{Population } <15 \text{ and } 60+}{\text{Population } 15-59} \times 100\right)$

Source: Table 14

estimated number of persons residing in cities at least doubled in the world as a whole and nearly trebled in the LDR between 1950 and 1975 (United Nations, 1980). A higher rate of natural increase and a higher rate of rural-urban migration contributed to the higher urban growth rate in the LDR than the MDR. Projections over the period 1975 to 2000 suggest that the urban population in the LDR may almost treble again within that time.

A rough inverse relation exists between the rate of urban population growth and the stage of economic development. For example, the rate of urban population growth for Africa is the highest among the eight major regions; it is estimated that Africa's urban population increased well over threefold between 1950 and 1975. Rapid urban growth has also taken place since 1950 in Latin America, South Asia, and East Asia.

As a result, the urban percentage of the total population in the world increased sharply during this period (from 29.0 percent to 39.3 percent). The relative increase in the percent urban was far greater in the LDR (from 16.7 percent to 28.0 percent) than in the MDR (from 52.5 percent to 67.5 percent). It is projected that the urban share of the total population in the LDR may rise from the 28.0 percent of 1975 to about 43 percent by the year 2000.

Latin America, the most urbanized of the less-developed regions, was more than 60 percent urban in 1975—only moderately below the average for the MDR. The level of urbanization is far lower in East Asia (32 percent in 1975) and lower yet in South Asia (22 percent). In Africa, low to very low urbanization levels are the rule among most of the countries in the tropical zone (26 percent overall).

Since urbanization has occurred primarily as a result of migration from rural to urban areas, particularly of young adults, the urbanization level falls after about age 30, moderately in the MDR and sharply in the LDR, and the percent urban at the older ages tends to be lower than for the rest of the population (table 15). For the MDR in 1965-1975, the average percent urban was 65 percent for ages 25 to 29 and 57 percent for ages 60 and over; for the LDR, the corresponding figures were 37 and 30. Africa shows unusually large declines in the urban proportion with rising age while in Latin America the urban proportion is nearly unchanged with rising age after ages 15 to 19. The percent urban for males aged 65 to 69 in Africa is only 17 percent, as compared with 48 percent for Latin America and 51 percent for Europe.

The decline in the percent urban after age 30 may also reflect migration from urban to rural areas, much of which is presumably return migration after accumulation of assets (LDR) or for retirement (MDR). Urban-rural differences in mortality may also play a role. Currently, mortality and morbidity in the LDR are believed to be higher in rural areas than in urban areas, while in the MDR there is a trend toward equalization of mortality and morbidity levels in the two areas. The more favorable levels of urban mortality as compared with rural mortality in the LDR should tend to raise the proportion urban with rising age in the LDR.

The greater concentration of public health and medical services and effective sanitation measures in urban areas are the primary determinants of the difference in morbidity and mortality between urban and rural areas. For example, it is estimated that in 1976-1977, 90 percent of all physicians in Kenya were located in urban areas, so that about only 100 physicians were available for the more than 10 million people in rural areas (United Nations, 1980). In Latin America, the health systems, including hospitals, are concentrated in the larger urban centers. A major need is to the more than one-third of the population which lives mostly in rural areas or in marginal dwellings in large cities and which does not

Table 15. Average Percent Urban for the Male and Female Populations 60 Years and Over, by Age: 1965 to 1975 and 1950 to 1964

Period and region	All ages		60 to 64 years		65 to 69 years		70 years and over	
	Male	Female	Male	Female	Male	Female	Male	Female
1965 to 1975								
Total sample	41.1	41.8	38.2	41.1	36.9	41.0	36.1	41.2
More-developed regions	59.1	60.4	55.8	59.2	54.1	58.8	53.3	58.9
Less-developed regions	35.5	33.9	30.8	33.5	29.6	33.4	28.9	33.6
Africa	23.9	22.6	19.3	19.4	16.9	18.5	16.2	19.0
Latin America	48.8	51.8	47.7	55.0	48.1	56.2	47.8	56.7
Northern America	71.4	72.9	67.0	72.1	65.9	72.0	67.3	75.8
East Asia	58.7	58.3	49.4	50.4	46.9	49.3	42.8	46.5
South Asia	28.0	27.5	26.1	26.1	25.2	25.9	23.9	25.8
Europe	55.4	56.8	52.4	55.9	50.9	55.6	49.6	55.2
Oceania	29.5	28.2	27.8	28.3	25.0	27.1	24.6	26.6
U.S.S.R.	56.6	56.0	51.1	51.6	40.8	46.6	44.7	48.7
1950 to 1964								
Total sample	36.6	38.0	34.9	38.5	34.2	39.0	32.6	38.5
More-developed regions	49.3	51.0	48.4	51.7	46.6	51.0	44.4	50.3
Less-developed regions	29.3	30.5	27.1	30.9	27.1	32.0	25.8	31.7

Source: United Nations, Patterns of Urban and Rural Population Growth, Population Studies, Series A, No. 68, United Nations, New York, 1980, table 43.

receive care of any kind (World Health Organization, Behm, 1981).

Rural areas in most regions of the world have higher proportions of older persons than urban areas (United Nations, 1980; United Nations, 1982). This is a result both of outmigration of young adults from rural to urban areas and return migration of older adults from urban to rural areas, and in spite of higher fertility in rural areas. This generalization appears valid for all major regions except Latin America. For Asia and Africa, the absolute differences between the proportions of older persons for the rural areas and the urban areas tend to be small although the numbers of persons involved are often quite large. The differences between the urban and rural proportions of the elderly for Southern and Eastern Europe and the U.S.S.R. are sizable, however. For example, in 1980, the proportion of persons 60 years and over in the rural population of the U.S.S.R. was an estimated 16.1 percent, as compared with 11.3 percent in the urban population.

From a numerical point of view, the problem of securing services for the rural elderly is greater than that for the urban elderly, both in the MDR and LDR. Because of the age profile in rural areas, a greater need for health services exists there than in urban areas. Yet these areas are deprived of youthful manpower which could contribute to the economic production of the area, to the resources, both financial and social, for supporting the elderly, and to the efforts made in rural development.

Large excesses of women at the older ages are mainly a characteristic of the urban population of the more-developed regions. Urban sex ratios (males per 100 females) for 1965-1975 decline rapidly after age 45 or so, especially in the MDR, reaching 61 at age 70 and over for the MDR and 86 for the LDR (table 16). Rural sex ratios decline with age only in the MDR and less rapidly than urban sex ratios. Urban and rural sex structures show tremendous diversity among the regions. The urban and rural populations of many less-developed regions do not show an excess of females in the older ages; males predominate in rural Latin America, urban and rural Africa, and urban and rural South Asia. The patterns of internal migration consistent with these patterns of sex composition are suggested below.

Changes in the age and sex distribution and, in particular, the proportion of older persons, in the urban and rural populations affect health conditions, mortality and morbidity profiles, and the need for health and health-related services in these populations. The geographic distribution of older persons will have an important impact on the types, prevalence, quality, and cost of health programs or health-related services. One of the reasons that Africa has experienced the least penetration by modern public health measures of any region is the wide dispersal of its population. The area is not only poor but must confront the additional problems and costs that arise from carrying out health programs over sparsely inhabited areas.

Table 16. Average Number of Males per 100 Females for the Urban and Rural Populations 60 Years and Over, by Age, for the More-Developed Regions and Less-Developed Regions: 1965 to 1975

Area	All ages	60 to 64 years	65 to 69 years	70 years and over
URBAN				
Total sample.....	102	96	94	78
More-developed regions.....	95	82	76	61
Less-developed regions.....	105	103	102	86
South Asia.....	109	113	117	105
Europe.....	94	82	77	61
RURAL				
Total sample.....	103	107	110	100
More-developed regions.....	101	96	95	79
Less-developed regions.....	103	111	116	108
South Asia.....	104	109	118	117
Europe.....	101	96	94	78

Source: Based on United Nations, Patterns of Urban and Rural Population Growth, Population Studies, No. 68, United Nations, New York, 1980, tables 46 and 47.

Internal migration. Internal mass movements have been responsible for the sharp shifts in the balance, and the sex and age distributions, of the urban and rural populations recorded for many countries. We can identify several specific types of movements. A principal type of movement, as has been mentioned, is the migration of young adults from rural to urban areas. As a result of this movement, characteristic of both the MDR and the LDR, the proportion of the elderly in the total (all-ages) population tends to rise in the rural areas, the areas of origin, and to fall in the urban areas, the areas of destination. In the United States, for example, it is reflected in the relatively high percentages of elderly in the States of the rural Midwest and the relatively low percentages of elderly in the urban industrial States of the East North Central division, and in the higher percentage of elderly in the nonmetropolitan population in 1980 (12.3 percent 65 years and over) than in the metropolitan population (10.2 percent).

Following the death of their husbands, many older women who live in rural areas, particularly in certain countries of Asia, move to cities, where they are less isolated and have greater access to the amenities of modern living. Moreover, they may have adult children in the cities who would feel obligated to care for them. Another common type of move is the return migration of recent widows or chronically ill older persons to their home States, towns, or villages. In many countries of Africa and Asia the urban-to-rural migration consists largely of males returning from urban to rural areas in older age.

Another type of movement in the MDR is the migration of older persons off farms to small towns located nearby when they give up farming. As a result of the inmigration of older persons and the outmigration of young persons, and in spite

of relatively high fertility, the rural-nonfarm (small town) population tends to have very high proportions of elderly persons. In the United States, this type of movement is reflected in the difference between the percents over age 65 in 1970 for rural towns (13.6 percent) and the farm population (9.6 percent).

In the MDR, the centrifugal and centripetal forces of migration have resulted in gerontic enclaves, both in large cities and in the suburbs of metropolitan areas (U.S. Bureau of the Census, 1984). Young adults may move out of the city into the suburbs, or out of various sections of the city into a few city areas, and the older folks may simply be left behind. Less commonly, some sections of the city may become particularly attractive to older persons already living in the city or to previous city residents living in the suburbs. The factors of low income, convenience of services, and relative inertia of older persons play an important role in the development of gerontic enclaves in the central cities, in addition to the factor of "congregation of kind." Similarly, suburban gerontic enclaves are emerging as households age and young family members leave to establish their own households.

Because of the higher concentrations of older persons in certain areas in the MDR, such as isolated rural areas, small towns, and deteriorated inner parts of large cities, these areas need extra health services. Yet, health services may be less available in these areas than elsewhere. The tendency of health professionals to settle in urban areas or to move from rural areas to urban areas creates a maldistribution of health personnel within many countries, both in the LDR and MDR, and a heavy concentration of health care services in urban areas at the expense of rural areas. The situation is quite different when older people move to planned "senior citizen" communities in suburban areas or to recognized "retirement" areas, as is true in some of the more-developed countries. These movers are likely to be relatively healthy because the very process of moving and adjusting to a new environment presumes a certain physical stamina. Moreover, the supply of health services is likely to be relatively ample in the area of destination.

In the LDR, the tremendous movement from rural to urban areas, especially of young persons, and the crowding of cities have greatly complicated the task of providing health and other social services to the urban population. The migrants to cities often live in makeshift housing under squalid conditions in shantytowns on the edge of town. Such conditions place an excessive burden on the health-service infrastructure. Fortunately, the proportions of older people in such urban settlements is low and the health problems characteristic of older age are not common. In the LDR, older people tend to remain in the rural areas, migrate to larger cities with their entire family, or rejoin other members of their family when a spouse dies. In any case, the problems of caring for older persons is a family responsibility unless the older person is too ill to remain at home.

International migration. In recent times, international migration characteristically begins in the relatively poorer countries and ends in the relatively richer countries. Migrants are especially drawn to countries experiencing rapid economic growth. International labor migration has played a major role in the recent economic development of the oil-producing countries of northern Africa and western and middle south Asia, for example. We may note also the largely economic migration from Asia and Latin America to Europe (especially the United Kingdom), Canada, and the United States.

The volume of international migration appears to have decreased in the 1970's. In particular, there has been a decrease in the flows into the countries of Europe and Canada, Australia, and New Zealand. This decrease is related to the recent economic trends in these countries and the pattern of decline is likely to continue in the 1980's.

It is characteristic for young adults to make up a disproportionate share of recent international migrants. This would be particularly true where the principal motive for migrating was economic. A demographic effect of this pattern of age-selective migration is to raise the proportion of young adults and lower the proportion of older persons in the receiving countries, with opposite effects on the age distribution of the sending countries.

A second, but less common, type of international movement is the return migration of former emigrants to their homeland at the older ages. For example, many migrants from southern Europe to the United States (e.g., Italy, Greece, and Turkey) have been returning to their homelands to spend the closing years of their lives. This movement intensifies the effect, on the age distribution of both the sending and receiving countries, of the previous emigration and immigration flows, reducing the proportion of elderly in the country of origin and raising it in the country of destination.

The influences of international migration on health conditions and on the need for health care resources are manifold (Hansluwka, 1974). Since migration between countries changes the age distribution of the sending and receiving populations, and since age groups differ in the types and extent of illness they experience, international migration causes a shift in the pattern of health conditions and in the amounts and types of health services required in the sending and receiving populations.

The migrants also may transmit new diseases to the place of destination and indirectly overburden existing health and social services. For example, movement of people has accounted for the transfer of malaria from malarious to non-malarious areas in Africa, the spread of cholera in Africa, the resurgence of tuberculosis in the United States, and the reappearance of smallpox in several European countries. Migrants may lack an immunity to certain diseases which are unknown or infrequent in their country of origin but prevalent in the country of destination, and to which the indigenous population may have built up an immunity.

Migrant groups, wanting to preserve their cultural identity may fail to use the health services of the host country, with adverse effects on their health. Generally, as the period of residence in the host country increases, the level and pattern of morbidity of immigrants shift from those of the country of origin to those of the country of destination. The health of migrants may improve or worsen. For example, gastric cancer has shown a reduced incidence among Japanese migrants in the United States as compared to its incidence among Japanese nationals in Japan.

MORTALITY AND MORBIDITY

Trends in Mortality and Life Expectancy

Past trends. The phase of the "demographic transition" that began in many parts of the developed world after the end of the 18th century and was characterized by declines in mortality was accompanied and followed in most of these countries by what has been called the "epidemiologic transition" (Omran, 1977). High infant and childhood mortality, usually due to infectious and parasitic diseases, has given way to low mortality in the early years of life and a concentration of deaths in middle or late adulthood, typically from chronic diseases. This process has largely been completed in the more-developed countries but is in the early stages in most of the less-developed countries.

The process of mortality reduction has been characterized by marked declines in age-specific death rates and marked gains in life expectancy in many countries. The gains in life expectation have not been uniform among countries and, as suggested, great differences exist between the MDR and the LDR. Table 8 presents estimates and projections of life expectation at birth in the world, the MDR and the LDR, and the eight major regions, for 1950-1955 to 2000-2020, as calculated by the United Nations.[8]

Great gains have been made in the improvement of health and the reduction of death rates in the LDR since World War II. In fact, until recently, changes in life expectancy at birth have been more rapid in the LDR than the MDR, where the "biological limits" of longevity have been approached more closely. Additionally, expansion in health programs relating to environmental sanitation (water supply and quality, sewage disposal), nutrition, and immunization has been greater in the LDR. An average increase of 13 years, from 42 years to 55 years, occurred in expectation of life at birth in these regions between 1950-1955 and 1975-1980, according to the estimates. During this 25-year interval, the gain in life expectancy was at least as great as the gain during the entire previous half century.

The expectation of life in the MDR in the early 1950's was nearly 23 years above the figures for the LDR. At that time, life expectation in the MDR was about 65 years. The gap was reduced to about 17 years in 1975-1980 as a result of the greater gain in life expectation in the LDR (nearly 13 years) than in the MDR (7 years). Life expectation in the MDR stood at about 72 years in 1975-1980.

The region of Latin America showed an almost spectacular increase in life expectation at birth after World War II, which pervaded the continent (Arriaga and Davis, 1969). Since the early 1960's, however, a reduction in the rate of gain in the Life expection in 1975-1980 was 62 years as compared with 57 years in 1960-1965 and 51 years in 1950-55. The difficulty of adding another year to life expectation increases as the level attained rises; hence, it is not surprising that countries most affected by the slowdown were those where rapid gains had been recorded earlier and relatively high levels had already been reached (e.g., Argentina, Cuba, Jamaica, and Puerto Rico). Of greater concern, however, is the fact that gains also appear to have slowed recently in some countries where the levels of life expectation were lower at the start, as in the Dominican Republic, Mexico, and Venezuela.

If life expectation at birth in the MDR in the mid-1970's is used as a benchmark, then a figure below 50 years may be considered as representing high mortality, 50 to 60 years as representing medium mortality, and a figure above 60 years as representing low mortality. Utilizing this scheme, one can classify 14 of the 27 principal Latin American countries (those having 300,000 or more population) as having low mortality, 2 (Brazil and Colombia) as being close to the borderline between medium and low mortality, and only 2 (Haiti and Bolivia) as still having high mortality.

As we have noted, the data available for sub-Saharan Africa are not adequate for developing reliable estimates of the gain in expectation of life or the change in death rates during the past quarter century. Although present health conditions are poor in this area, they undoubtedly represent a significant improvement over those which prevailed a quarter of a century ago. There is reason to doubt, however, that rapid declines in mortality occurred during the decade of the 70's in many African countries (International Union, Azefor, 1981). From the limited data available and in spite of the lack of accurate measures of mortality, it appears that mortality in Africa south of the Sahara is higher today than in any other major area of the world.

Similarly, while the decline in mortality in some of the Asian countries was observed as having been unprecedentedly fast during the immediate post-World War II years, the decline is now apparently slowing down in several of the Asian countries (International Union, Sivamurthy, 1981). This decelera-

[8]It should be observed that death statistics are either lacking or incomplete in many developing countries, especially those in Africa, East Asia, and South Asia. Consequently, the estimated expectation of life for these major areas and the combined figure for the less-developed regions have relatively low reliability. The absence of published national vital statistics for China since the late 1950's makes firm estimates of mortality indices for the East Asia area as a whole impossible. In South Asia, reliable figures on life expectation are available for only a few countries. These make up a small percentage of the area's population and are not representative of conditions in the whole. The statistical basis of mortality estimates for Africa is even weaker, except for Northern Africa. Latin America is the only major area in the less-developed regions where the data are adequate to serve as a basis for fairly reliable measures. Without accurate and reliable death registration data, it is difficult to assess the current health situation of the older population and project future developments.

tion of the decline in mortality is occurring when mortality rates of these countries are still relatively high. Using the classification scheme for life expectation referred to above, 42 countries of Asia can be assigned as follows: 9 clearly have low mortality, 13 clearly have high mortality, and 20 belong to the medium mortality group.

Gains in life expectancy have not been uniform for the various age groups or both sexes in the MDR and the LDR. As already noted, during the last century, gains in the MDR have been greater in childhood and young adulthood than in the middle and later years, primarily through the reduction of infectious and parasitic diseases. The increase in life expectancy for older adults in the MDR has been smaller, at least until recently; this is associated with the fact that the major causes of death affecting older adults are heart diseases, cancer, and cerebrovascular diseases.

There is a rough direct relationship between mortality at the older ages and the general mortality level. Regional variations in the life expectation at age 60 follow the same pattern as life expectancy at birth, namely lower values in Africa, Latin America, and South Asia, and higher values in Europe, Northern America, and the U.S.S.R. (figure 6). Life expectation at age 60 was 18 to 19 years in Northern America, Europe, and U.S.S.R., and about 14 years in Africa and South Asia. Relative differences in life expectancy at the older ages among the major regions in 1975-1980 were smaller than at the younger ages, however. Life expectation at birth was about 30 percent greater in the MDR than the LDR in 1975-1980 and life expectation at age 60 was about 24 percent greater.

There are considerable differences in life expectation both at birth and at age 60 between the sexes in the MDR (table 13). These vary from about 4 years in Israel and 6 years in Sweden, Norway, Denmark, and the Netherlands, to about 9 years in Finland and 10 years in the U.S.S.R. for life expectancy at birth, and from 2 to 5 years for life expectancy at age 60. Much of the difference between the sexes in life expectation at birth in the MDR can be explained by the difference at the older ages.

Mortality differences between the sexes have been widening in the MDR over several decades. The divergence occurred in virtually all ages and all leading causes of death. In some developed countries, however, the pace of divergence in the life expectation of the sexes has been slackening in the last decade and even a leveling off has occurred. In the United States, for example, between 1970 and 1978, the pace of the secular trend of the difference in life expectancy slowed down and, for some specific mortality indicators, differences in the mortality of the sexes actually narrowed (Verbrugge, 1980). On the other hand, none of the more-developed countries has shown a clear reversal of the difference in life expectancy at birth or at age 60 between the sexes, even considering those more-developed countries with the smaller male-female differences.

Much has been written about the factors accounting for the difference in the mortality of the sexes in the MDR. Biological and environmental factors are both influential and operate conjointly and interactively. While life styles, working conditions, and culturally circumscribed sex roles contribute to the difference, there is evidence of a basic biological advantage for women. There is also strong evidence to suggest that a considerable part of the divergence of the mortality of the sexes in this century resulted from environmental factors, particularly smoking.

In the LDR, the prevailing pattern shows a small to moderate excess of male mortality (table 13). The average differences in life expectancy at birth and at age 60 in 1975-1980 for the LDR were 1.8 years and 1.3 years. Evidently much of the difference in life expectancy at birth between the sexes can be accounted for by the difference in death rates at the older ages. There are several countries in South Asia (namely, Pakistan, India, Nepal, and Iraq) which show an excess of female mortality, presumably resulting from the lower social status accorded to women and the corresponding relative neglect of girls.

Cause of death. In most of the less-developed countries, death rates across the age span have been declining rapidly because of major gains in the eradication of many infectious and parasitic diseases. While these gains have been greater for the young than for the old, and greater for females than for males, all population groups in these areas have shown improvements in their survival records from this source. In general, the principal lagging group is the poor, especially the rural poor.

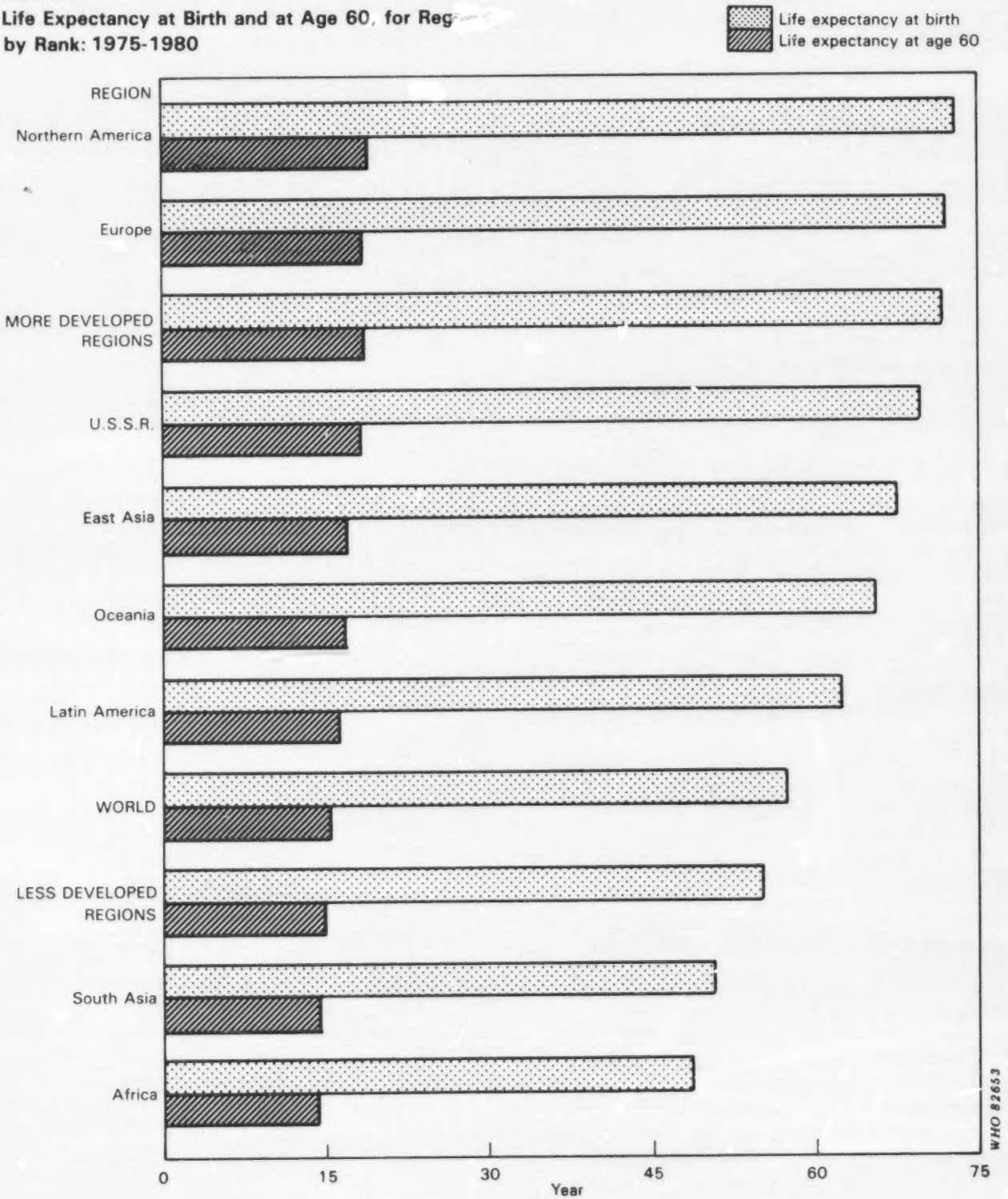
The specific causes of death responsible for mortality change in the LDR have not been satisfactorily established. The principal reason for this situation is that most of the less-developed countries cannot provide data on cause of death, and the data for the few other less-developed countries are seriously defective (i.e., subject to errors of completeness and misreporting). However, the information available permits a rough evaluation of the role of the various causes.

The infectious and parasitic diseases (e.g., typhoid, typhus, cholera, measles, diptheria, whooping cough, malaria) account for only an estimated one-quarter of mortality change in this century in the LDR (Preston, 1980; Preston and Nelson, 1974). The category of respiratory diseases, which comprises an array of respiratory problems including respiratory tuberculosis, is more important. A major uncertainty relates to the role of malaria. For some areas (i.e., British Guiana and India), malaria's contribution equals or exceeds the contribution estimated for all other infectious and parasitic diseases combined. The importance of malaria as a component of mortality declines in a country depends upon whether the disease was endemic and whether effective antimalarial campaigns were carried out. Each death assigned to malaria represents two to four deaths directly or indirectly caused by it. The additional deaths result from malaria's role in weakening its victims and rendering them vulnerable to a variety of illnesses.

Although death rates from infectious and parasitic diseases and from respiratory diseases have declined significantly in the LDR, some of these types of mortality conditions are still prevalent for some age groups in many countries. In the late

FIGURE 6.

Life Expectancy at Birth and at Age 60, for Reg[illegible] by Rank: 1975-1980



Source: Table 8.

1970's, more than 20 percent of all deaths in some African, Asian, and Latin American countries were due to diarrheal diseases and other diseases for which control measures involve primarily environmental improvements. Viral diseases, rickettsial diseases, and parasitic diseases such as dengue, schistosomiasis, and malaria continue to be endemic and still can reach epidemic proportions in many of the less-developed countries (Cohen, 1981). Malaria is highly endemic in tropical Africa and has not generally been successfully attacked there. While the increased efforts at diagnosis, surveillance, and environmental control of these diseases have been quite effective in many areas, the increased costs of the control measures and the emergence of resistant strains suggest that these diseases pose problems for health maintenance that will persist in many areas for some time to come.

Preston and associates have shown that infectious and parasitic diseases bear almost exclusive responsibility for shortening life expectancy in high-mortality populations below current Western levels of 69 years for males and 75 years for females (Preston, 1980; and Preston and Nelson, 1974). When life tables are recalculated after eliminating deaths from infectious and parasitic diseases, the resulting life expectancies generally fall between 65 and 70 years for males and between 70 and 75 years for females, regardless of a population's initial mortality level.

The success of programs to treat and prevent infectious and parasitic illnesses and the success of family planning programs in reducing fertility in the LDR are producing both a changed pattern of mortality and morbidity and a changed population structure in these countries. The number and proportion of older persons in the population are rising and, as the population "ages," disorders such as chronic respiratory conditions, neoplasms, and many of the cardiovascular diseases will account for an increasing proportion of the morbid conditions affecting the population. Even now a substantial portion of all deaths, i.e., a fifth or more, can be assigned to the above cause-classes in some less-developed countries (Hull, Lopez, and Rhode, 1980).

In summary, declines in most exogenous causes of mortality have been occurring in many parts of the less-developed world and, in some parts, they have been occurring at an accelerated pace compared to the historical experience in the MDR. (Exogenous diseases are defined as those caused by infection, parasites, and external trauma or, more generally, are those potentially preventable with current knowledge.) Endogenous diseases now dominate the cause-pattern of the MDR and are becoming increasingly important as causes of death in the LDR. (Endogenous causes are those that appear to have a significant biological and genetic component and, hence, are more resistent to control, such as neoplasms, diseases of the circulatory system, diabetes, and nephrosis.) In the MDR, the trend of death rates from these causes has been quite variable from cause-to-cause, age-to-age, period-to-period, and country-to-country. In some more-developed countries, the rate for certain endogenous causes (e.g., heart diseases) have shown spectacular declines in recent years after a period of stagnation or increase, while for others (e.g., neoplasms) the rates have continued to rise.

Prospects for longevity. Whether mortality trends in the LDR will follow the same course as in the MDR is problematic. It remains to be seen whether death rates in the LDR for endogenous causes will first increase before declining as they did in the MDR, or whether the decrease in the MDR is the beginning of a more universal trend of decreasing mortality from endogenous diseases.

United Nations projections of life expectancy at birth anticipate much larger mortality reduction in the LDR than in the MDR between 1975-1980 and 2020-2025, but the pace of improvement will slacken as compared with the period since 1950 (table 8). Whereas the MDR are expected to gain only 3.5 years in life expectancy at birth by the year 2025 (reaching 75.4 years), the LDR are expected to gain 14.5 years (reaching 69.6 years). Nevertheless, even in that year a substantial difference (6 years) in life expectancy at birth is projected to remain between the two world regions. By 2025 it is anticipated that the range for life expectancy at birth among the major regions will be far narrower than at present. Life expectancy in Africa and South Asia, the two regions with the lowest figures today, would exceed 67 years, after gains of 18 or more years. Future increments for the more-developed regions are expected to be small; life expectancy at birth in Europe, for example, would be only 3.7 years greater in 2025 than in 1980, reaching 75.7 years.

The outlook for longevity in the MDR should take into account the possibilities of reducing death rates through the extension of existing methods of health care and treatment to geographic and socioeconomic segments of the population not now fully covered, the development of new treatment modalities for specific conditions, and the discovery of techniques of slowing the aging process. There is strong evidence, too, that the force of many of the genetic and environmental factors affecting longevity can be changed by modifying one's personal behavior (e.g., diet, exercise, smoking) (International Union, Nightingale, 1981; International Union, Susser, 1981) and by community action (e.g., health education efforts, pollution control, industrial safety). Some of the problems implied, such as the maldistribution of health care resources, socioeconomic differences in mortality, and the adverse effect of certain types of personal behavior and environmental conditions on health, are considered in later sections.

Death rates in the MDR may be expected to fall further, particularly in the lagging areas, and the longevity of the population in the MDR may be expected to continue to rise for at least the next several decades. This conclusion is indicated by the considerable variation among the individual countries and by the possibilities for further progress in the leading countries. The fact that substantial declines in death rates for some of the chronic causes of later life have been occurring among the adult and aged populations of many of

the more-developed countries in the last decade or so, strongly suggests that further gains in prolonging life are still possible.

A historical and comparative analysis of mortality patterns suggests a basis for establishing expectations with regard to both mortality and longevity for the year 2000 and beyond. According to Bourgeois-Pichat, the "limits" of longevity may be estimated by using a model in which exogenous causes of death are eliminated and only endogenous causes of death continue (Bourgeois-Pichat, 1952). He noted that by the early fifties the battle against exogenous diseases had largely been won in most of the more-developed countries through general public health and sanitation measures, vaccination and immunization, and direct treatment by specific medication; endogenous diseases do not respond as well to these methods. Bourgeois-Pichat made assessments of the "limits" of longevity in 1952 and again in 1977 on the basis of endogenous mortality in Norway, and found that little progress was made in this quarter century (Bourgeois-Pichat, 1952, 1979a, 1979b). According to his calculations, the "limits of life" in terms of life expectation at birth were 74 years for males and 80 years for females. More recently, in spite of a rise in endogenous mortality for males between 1952 and 1977, Bourgeois-Pichat has suggested the possibility of major declines in the death rates from the endogenous causes on the basis of current and prospective research in molecular biology designed to delay the aging process (WHO, Bourgeois-Pichat, 1981).

As noted earlier, a substantial portion of so-called endogenous mortality can be postponed, if not prevented, by changes in personal lifestyle, the environment, and the health care delivery system. There is evidence that many persons are adopting personal habits conducive to better health as a result of public health education, changes in advertising practices backed by legal pressures, and advice from private health practitioners.

Apart from any possible future successes in slowing the aging process through advances in molecular biology, these studies appear to be consistent with the view of Fries and Crapo that anticipates early achievement of a nearly complete "rectangularization" of the survival curve. Specifically, under these conditions, relatively few persons die before extreme old age and most persons die of "natural causes" (that is, without specific major pathology) in a narrow span of ages, such as 85 to 95, just short of the human life span (Fries and Crapo, 1981). This result could be approximated through the virtual elimination of all or nearly all exogenous mortality and reductions in endogenous mortality from changes in personal life styles and the health care delivery system. It is doubtful whether this goal can be achieved without a massive buildup in the numbers of persons with chronic and disabling conditions.

The prospects for reduction of the differences in the death rates and convergence of the life expectancy values for males and females is of special interest in gerontological studies. Reference has already been made to the often considerable differences between the sexes in life expectation at birth and at age 60 in the MDR. It was noted also that there is evidence in some developed countries of a leveling off of the difference in life expectation between the sexes in the last decade, but that there is no record of a narrowing of the difference. Since both biological and environmental factors are believed to be jointly responsible for the difference, the inference may be made that complete convergence of life expectancy for the sexes in the MDR is not to be expected in the forseeable future. At most, a moderate convergence of life expectancy, both at birth and at the older ages, may be anticipated in the next several decades in the MDR.

In this connection, changes in the lifestyles of men, including, particularly, reduced smoking and better dietary habits, and changes in the roles and life-styles of women, including, particularly, increased smoking and greater participation in the labor force in a wide variety of responsible, physically demanding and even hazardous occupations, may contribute to the convergence. More important may be changes in the personality structure of the two sexes resulting from greater similarities in the way boys and girls are reared and resulting in greater similarities in the way men and women respond to stress.

The U.N. projections of life expectancy at birth for the two sexes in the MDR imply a very slight narrowing of the male-female gap from 7.3 years in 1975-1980 (table 13) to 7.0 years in 2020-2025 . The present male-female gap of 5.9 years for Sweden may be an achievable gap for the MDR as a whole in 2025, however.

In the LDR, as we have noted, the difference between life expectancy at birth for the sexes is much smaller, and the possibility for a widening of the gap as the mortality levels of the MDR are approached needs to be considered. It seems reasonable to hypothesize that the LDR will follow the course of the MDR in experiencing an increase of the male-female gap as their death rates fall and that the gap may even approximate that in some of the more-developed countries today. The U.N. projections imply only a moderate widening of the male-female gap from 1.8 years in 1975-1980 to 4.0 years in 2020-2025.

Personal Factors in Longevity

It is now widely recognized that personal habits and lifestyle may greatly affect the risks of illness and death. Among the factors that appear to be significant are exercise, nutrition and eating habits, smoking, use of alcohol, occupational stress, and sleeping habits (International Union, Nightingale, 1981; International Union, Susser, 1981). Some of these factors (e.g., exercise, nutrition, stress, and sleeping habits) are basic dimensions of everyday life; hence, they become problems only under certain circumstances, mainly in their extremes.

Arduous physical work under airless and unclean working conditions (e.g., mining, steel-making), especially over prolonged periods during one's lifetime, appears to militate against longevity. This type of experience applies to many

persons in the LDR and, even today, to the lower socioeconomic classes of the MDR. In general, however, the problem in the MDR is the very opposite. Contemporary life, especially in the MDR, is a life of relative inactivity, and such life, it appears, can be "dangerous to one's health" (Burney, 1972). Although aging can itself cause inactivity, it is just as likely that inactivity hastens the aging of body systems. In fact, there is good evidence that regular moderate exercise has a beneficial effect on the length and quality of life (U.S. Public Health Service, 1979; Sourander, Ruikka, and Kasanen, 1970; Svanborg, 1977).

Satisfactory nutrition requires a diet that is neither excessive nor deficient in calories and basic nutrients. The diets of much of the older population in the LDR and the poor elderly in the MDR are inadequate either with respect to the quantity or the quality of food eaten (Pan American Health Organization, 1980; World Health Organization, 1974). For these populations, it is a question of insufficient food and food of poor quality. The role of food supply in the LDR is discussed further in a later section.

For the general population of the MDR, however, it is "overnutrition" and overeating that pose special risks. A diet with excessive calories accompanied by inactivity, and an unbalanced diet, mainly a diet with excessive fat, salt, and sugar and lacking sufficient fiber, such as characterize the U.S. population, have been linked not only to obesity, but to specific morbid conditions. About 14 percent of the male population 20 to 74 years of age in the United States, and 24 percent of the corresponding female population, for example, have a weight 20 percent in excess of an acceptable average weight, according to the U.S. Health and Nutrition Examination Survey of 1971-1974. The evidence for the effect of mild to moderate obesity on longevity is not determinative; some obesity in older age may in fact be salutory as a reserve in case of illness. The evidence for the effects of pronounced obesity on conditions like diabetes, hypertension, and heart disease is strong, however (Dwyer and Hetzel, 1980; Young, 1979). There is also strong evidence for the adverse effects of diets with excessive fat and salt on the health of middle-aged and older persons; these items have been indicted for their role in malignant neoplasms and cardiovascular diseases.

Some of the personal factors having an important impact on adult mortality are dispensable, unlike exercise, nutrition, and sleep. These factors are smoking, accidents, especially motor vehicle accidents, and alcohol consumption. Mortality associated with smoking and accidents is high and increasing in the MDR. Mortality linked with these factors is still relatively low in the LDR, but is rising even more rapidly than in the MDR, as the use of cigarettes and motor vehicles increases in those areas. While the major effect of these factors is seen in premature mortality, especially from accidents, the number of elderly persons disabled by conditions associated with smoking, such as chronic obstructive lung disease, and by motor vehicle accidents is also increasing (United Nations, 1970 to 1980).

The evidence on the relation between smoking and longevity is quite cogent. Studies from many of the MDR have found that persons who have smoked heavily and over a number of years, have sharply reduced their relative length of life (Burney, 1972; U.S. Public Health Service, 1979). The large proportion of persons who have been heavy smokers has substantially reduced measured life expectation for the general population. Public and private efforts to reduce smoking have been considerable, but with limited effectiveness.

One specific indicator of the effect of accidents on longevity is the level of life expectation when accidents are eliminated. Life tables eliminating accidents as a cause of death for the United States in 1969-71 show that 1.3 years would be added to life expectation at birth if all accidents were eliminated and 0.7 year would be added if motor vehicle accidents alone were eliminated.

Alcoholism is a major health problem in both the MDR and LDR and is the primary cause of cirrhosis of the liver. Present research indicates that moderate drinking is associated with lower rates of cardiovascular illness and other stress-related illnesses but that spasmodic and heavy drinkers run excessive risks of cardiovascular illness and liver disease.

The U.S. Public Health Service has estimated that about one-quarter of the mortality in the United States from heart disease, cancer, cerebrovascular disease, and arteriosclerosis can be attributed to genetic factors and that lifestyles, the environment, and the health care delivery system account for the remaining three-quarters or so (U.S. Public Health Service, 1978; Clogg, 1979). Lifestyle alone accounts for 54, 37, 50, and 49 percent of the mortality from these diseases, respectively. A study of Belloc and Breslow and a follow-up study by Wiley and Camacho reported that 45-year-old men who practice seven healthful habits (exercising regularly, maintaining moderate weight, not snacking, eating breakfast, not smoking, drinking moderately, sleeping at least seven hours each day) would gain several years of life over those practicing three or fewer of these habits (Belloc and Breslow, 1972; Wiley and Camacho, 1980; International Union, Nightingale, 1981).

Finally, there is evidence that regular mental and social activity is a positive factor in maintaining health and effective functioning in later years. Filling meaningful social roles on a continuing basis and engaging in a large number of satisfying and appropriate interpersonal "transactions" may be as important in maintaining health in later years as the personal habits enumerated (Berkman and Syme, 1979).

Morbidity and Functional Limitations

Information on the incidence and prevalence of specific acute and chronic health conditions among the older population, as well as information on disabilities and functional limitations, is required to measure the state of health of the elderly and their need for health and social services as well as to plan future health services for them. The measures of morbidity may be based on the elderly person's report of

perceived health status, medical diagnosis, or use of various health services (physician, dentist, and nurse visits; hospital admissions and hospital-bed days), on an employer record of sick leave, or on a health examination record or hospital admission-discharge record. Measures of disability and functional limitations may be based on data from similar sources or data on the living arrangements of the person. Independence of functioning can be measured, for example, by whether one resides in a private home, congregate housing, or an institution (e.g., nursing home), with specification of the extent of supportive services. Recognizing the need for the development and promulgation of such data and measures, the World Health Organization and the International Epidemiological Association issued a book on *Measurement of Levels of Health* in 1980. It provides a broad range of measures and examples of their use in many areas of the world.

Little firm information is available on the health conditions of the elderly, particularly in the LDR. While information on morbidity is sometimes available, data on disabilities and functional limitations are generally lacking. A survey of sources of information about the health of the elderly carried out by the World Health Organization in 1971 found that only 17 of the 102 countries responding had conducted any surveys of the health status of their elderly population, and only 14 had information on disabilities for this group (World Health Organization, 1972). The fact that health interview surveys have been conducted in an increasing number of countries, sometimes on a periodic basis, suggests, however, that information is available that would permit some cross-national comparisons directed specifically to the health problems of the elderly.

For countries to understand and provide for the health needs of the elderly, it is essential to have more information on the need for health services than is now available. The tasks of setting priorities and making effective choices under circumstances of limited resources required in different degrees both in the MDR and the LDR, make such information essential.

Morbidity. In the more-developed countries for which there are data, older persons suffer less from acute (short-term) conditions and more from chronic conditions than younger persons, but the duration of the acute as well as the chronic conditions is longer for older persons. Older persons also suffer more from chronic conditions that are lethal (conditions which can lead directly to death) than younger persons.

Older persons make more visits to physicians per person than younger persons. They have relatively high rates of admission to general hospitals compared with younger persons, and stay considerably longer in the hospitals. The effect of aging is more pronounced in the number of hospital in-patient days, therefore, than in the number of admissions. For instance, in the Netherlands, one hospital admission is registered every year for every six persons 65 years old and over but patients 65 years old and over account for one-quarter of all in-patient days (Bonte, 1980). Persons 65 years old and over record an average duration of stay of 28 days in the Netherlands.

The dominant chronic lethal conditions in the MDR are heart disease, malignant neoplasms, cerebrovascular disease, influenza and pneumonia, arteriosclerosis, diabetes, bronchitis, and emphysema—all principal causes of death among the elderly in the MDR. In contrast, the dominant chronic lethal conditions in the LDR are various infections of the intestinal and respiratory tracts, including enteritis, diarrhea, influenza, and pneumonia, and heart disease, cerebrovascular disease, and neoplasms—often causes of death at all ages in the LDR.

Several chronic conditions that are not common causes of death, e.g., hypertension and nutritional deficiencies (undernutrition, malnutrition), typically contribute to conditions that are lethal. Hypertension is associated with a large proportion of deaths in the MDR, and undernutrition and other nutritional deficiencies are associated with a large proportion of deaths in the LDR.

The major nonlethal chronic conditions affecting the elderly in the MDR are arthritis and other conditions of the musculoskeletal system, various sensory impairments (mainly conditions affecting vision and hearing), and edentulism (toothlessness). Older persons also suffer from a higher-than-average rate of mental illness, particularly depression. These conditions are widespread in the LDR also, presumably more widespread than in the MDR, although adequate data are lacking.

Various communicable chronic diseases, particularly malaria, are also widespread in the LDR. Malaria is one of the major causes of impairment and disability in the LDR. In Africa, for example, 10 percent of hospital admissions are due to malaria (World Health Organization, 1976). Conditions of the musculoskeletal system (e.g., arthritis) figure heavily in the noncommunicable somatic group of diseases in the LDR. It has been estimated that, while 2 percent of the British population suffers from "disabling rheumatism," 11 percent of the population of Jamaica has probable or definite rheumatic arthritis.

Impairments of vision and hearing represent an important class of health problems among the elderly, particularly in the LDR. Hearing loss and deafness are the common impairments of the auditory system associated with older age. In the United States, 29 percent of the population over age 65 had a hearing impairment in 1977, and over 4 percent could not read newsprint with corrective lenses, according to the U.S. Health Interview Survey. The principal health conditions of the eyes in the LDR are glaucoma, trachoma, xeropthalmia resulting from vitamin A deficiency, and blindness resulting from trachoma. Trachoma may be the most widespread infectious disease in the world. It affects an estimated 400-500 million people, of whom 2 million are believed to be completely blind and another 8 million so visually impaired as to be unable to carry on useful work (World Health Organization, 1976).

Poor oral health is another common health problem among the elderly. The lack of teeth or poor fit of dentures typically affects the ability to chew, reduces appetite, limits the choice of food, and lowers nutritional levels. The studies available uniformly report that the dental and general oral health of the elderly is very poor and that many people are in need of dental treatment. Most studies providing information on the oral health of older persons have involved persons living in institutions in more-developed countries. It is also important to examine data for older persons living in the community. In a recent study of older persons living in the community in England, it was found that three-quarters of the group were edentulous (Smith and Sheiham, 1979). Over half of the group (59 percent) had lesions in the mouth and about a third complained of oral pain or had difficulty chewing. Studies conducted in other more-developed countries found an even higher proportion of edentulous persons among the older population.

While little is known about the extent of dental problems in the LDR, there is scant reason to assume that dental health is better in the LDR than in the MDR. It is apparent that there is a great need for broad-based data on dental health conditions and care if comprehensive health planning is to be effective, especially in the LDR.

There appears to be a pronounced difference in morbidity rates between the sexes in the MDR, as indicated by physician visits. Older women consult physicians more often than older men, even though mortality is lower for women (Svanborg et al., 1977; Verbrugge, 1976). The conditions affecting women are not commonly life-threatening (e.g., arthritis), whereas the conditions from which men suffer are usually more severe and, hence, more life-threatening (e.g., respiratory and cardiovascular diseases). One explanation of the apparent difference between the sexes in morbidity rates may be the greater willingness and disposition of women to visit physicians when they have a health problem. This tendency may result from the greater social acceptability of illness among women and their stronger personal habits of visiting physicians shaped by experience with pregnancy, infant care, and menstrual problems. Another explanation for the difference is related to the demographic characteristics of the elderly. Since elderly women are more likely than elderly men to be widowed and to be living alone, that is, living without the company of another member of the household to care for them in case of illness, they are more likely to visit doctors for advice and care when the need arises.

If we consider measures of longevity and mortality as indicators of general health conditions, available data would suggest that the health prospects of older persons in the LDR in the near future are far poorer than the current health situation of older persons in the MDR. Understanding the epidemiologic transition is crucial for anticipating the probable future patterns of change in the health and mortality of the elderly population in the LDR. Health planning personnel in the LDR will have access to the findings from the costly research conducted on chronic conditions and deaths due to endogenous causes in the MDR and, if these conditions become prevalent in the LDR, the prior experience of the MDR should prove to be advantageous for health planning personnel in the LDR. The new cause pattern of morbidity and mortality will call for greater provision for the management of chronic conditions and an increased commitment to provide for the care of the middle-aged and elderly.

Functional limitations and disability. Alternatively, one can consider the health of the elderly in terms of the extent of disability, limitations on activity, and the degree to which independent functioning is possible. Little is known about the effects of various illnesses with respect to limitations on activity or disability.

The percent of persons who are physically disabled or handicapped, or who have a limitation on major activity, rises sharply with increasing age. In the MDR, the percent of persons aged 65 and over reporting chronic conditions with disability is 3 to 5 times higher than for persons 15 to 44 years of age. In the Netherlands in 1971-72, the percent of persons over age 65 who were physically handicapped (29 percent) was over three times as great as for the total population (9 percent) (Bonte, 1980). In this, study 81 percent of the handicaps resulted from illness or aging rather than from birth defects or accidents; the diseases causing the handicaps were principally chronic and degenerative diseases. In the Netherlands, 80 percent of the beds in nursing homes are occupied by persons 65 years of age and over. It is also estimated that 55 percent of the contacts between nurses and clients in home nursing services involve elderly clients.

In the United States in 1978, 38 percent of the population aged 65 and over had a chronic condition resulting in a limitation in major activity, as compared with 11 percent of the total population (U.S. National Center for Health Statistics, 1979). In 1972, 18 percent of the population 65 years and over had some limitation of mobility due to chronic conditions while 3.2 percent of the total population fell in this category (U.S. National Center for Health Statistics, 1974). Some 5 percent of the elderly population were confined to the house.

It is apparent that, in general, older persons require more health and social services than younger people. Furthermore, health service requirements will tend to rise as a result of the increased number of elderly and the aging of the population. A simple measure of expected need may be derived by applying age-specific proportions or ratios of prevalence or services performed, observed at some recent date, to the expected age distribution at some future date. Services dealing primarily with care of the elderly, such as nursing home admissions and home nursing visits, would show large increases, as would the number of physically handicapped persons. On this basis, between the mid-1970's and 1985, the number of physically handicapped persons in the Netherlands would increase 19 percent, home nursing visits would increase 8.5 percent, and admissions to nursing homes would increase 17.3 percent (Bonte, 1980).

In the MDR, the vast majority of the elderly are well enough to be able to continue living full lives, even if some of their activities have to be limited because of physical decline. A study of 70-year-olds in Sweden found that only about 3 percent of this age group were so ill or handicapped that they required institutional care (Svanborg et al., 1977). Another 2 percent needed daily assistance in personal care, and 10 percent had some difficulty walking or rising from a bed or a chair. Four out of five still maintained their own living accommodations and carried out such tasks as laundry management and shopping without help. Studies for other more-developed countries, although more limited in the size of the population covered or the scope of the inquiry, report essentially similar patterns of functioning on the part of the elderly (Cohen, 1981; Burney, 1972; Palmore and Stowe, 1973; Ronder et al., 1977; Sourander, Ruikka, and Kasanen, 1970).

In general, similar data are not available for the less-developed countries. WHO prepared some estimates of the number of disabled persons of all ages in the world for its documentation for the International Year of Disabled Persons (World Health Organization, 1976). According to the estimates, which are viewed as conservative and subject to considerable error, about 10 percent, and possibly as much as 13 percent, of the world's population is disabled. Disability is, therefore, a major medical, social, and economic problem in the world. Surveys in some more-developed countries show an estimated 10 percent of the total population, and a much higher proportion of the poor population, to be disabled. The evidence is that the prevalence of disability is associated with depressed socioeconomic conditions, such as exist in the LDR. On this basis, it is reasonable to estimate that the proportion disabled in the LDR may be as high as 13 percent and that the proportion disabled among the population over age 65 in the LDR may far exceed 50 percent.

SOCIOECONOMIC CHARACTERISTICS AND FACTORS IN MORTALITY

Social Factors

The marital status and living arrangements of individuals are important elements affecting their social and economic welfare, and the role of the family is crucial in economic and social welfare programs for the elderly. Any improvement in the general well-being of the elderly must begin with the family, which continues to provide many types of support for this group, including social, psychological, and economic support. Whatever its form, the family is usually an important source of assistance to the elderly in providing short term health care and in securing appropriate health and health-related services for elderly members.

Marital status. There are pronounced differences in the marital distribution of the population at the older ages between the MDR and LDR, and between the sexes in each class of areas. In the United States in 1980, for example, 1 out of 2 women over age 65 was widowed and 2 out of 5 were married, but for men the percentages were sharply reversed. Only 6 percent of the women and 5 percent of the men have never been married. This pattern, characteristic of the MDR, results from the much higher mortality rates of men than women, the higher remarriage rate of older men than older women, and the tendency of males to marry younger women. It also reflects the tendency of the vast majority of men and women to marry sometime during their lives.

In India in 1971, on the other hand, nearly 3 out of 4 women over age 65 were widowed and only 1 out of 4 was married; for men, the percentages were almost exactly reversed. Less than 1 percent of the women and 3 percent of the men have never been married. In general, in the LDR, the median age at first marriage of women is below or at age 20 and only a slight percentage of all older persons have never been married or are divorced. A very high percentage of elderly persons, particularly women, are widowed because the chances of death of one of the spouses by age 65 is very great and remarriage of widowed persons is uncommon. These conditions apply essentially, for example, to Kenya, Ghana, Senegal, Bangladesh, Indonesia, Pakistan, Jordan, and Honduras, as well as to India (Lightbourne, Singh, and Green, 1982; U.S. Bureau of the Census, 1980).

In general, in the MDR and the LDR, status pressures, social expectations, and customs result in a high percentage of men and women marrying by age 60. Such pressures are greater in the LDR than in the MDR. The percentage of the population which has never married is affected, however, by the extent of the practice of consensual unions (i.e., cohabitation of unmarried couples) and late marriage. Hence, percents never marrying are comparatively high in Sweden, Ireland, and many countries of Latin America.

Health is related to marital status both as determinant and consequence. Both types of influences affect the differences in morbidity and mortality rates for marital classes, and it is not easily possible to disaggregate them. On the one hand, health may be a selective factor in marriage formation and dissolution. Ill health may make an individual a less desirable marriage partner so that he or she is more likely to remain single or to terminate marriage through divorce. Ill health may also lead to dissolution of a marriage through premature death of a marriage partner. On the other hand, living under particular marital conditions may itself influence one's health. The regularity in personal habits and style of life imposed by marriage would be expected to contribute to better health. The marital status of individuals affects the social response to health problems; for example, the chance of a person having an appropriate diet, having an illness treated, or avoiding hospitalization or institutionalization in the event of illness or incapacity. Individuals living alone would seem to run special risks in this regard. Furthermore, the "parameters" of the marriage and the marital status of parents affect the health of the children born to the marriage and their life chances.

There is evidence for many of the more-developed countries that mortality rates vary according to marital status. The current pattern for the MDR is as follows: Married men and

women have lower death rates, and divorced men and women have higher death rates, than single and widowed men and women. Additional and improved data are needed before similar generalizations can be made on the relation between marital status and mortality rates in the LDR.

Living arrangements. The variations in the marital status of the sexes at the older ages are closely related to differences in the living arrangements of older men and women. Men, to a much greater extent than women, tend to be found in intact nuclear families at the older ages. In 1980 in the United States, for example, 67 percent of males 65 years old and over lived in households with spouse present, whereas only 33 percent of females lived in such households. Elderly females live alone much more often than elderly males; 34 percent of elderly females lived alone in the United States in 1980 compared with 15 percent of elderly males. These differences have tended to widen in the recent past as a result of both changes in the role of demographic factors and shifts in customs and mores.

In the United States, the percentage of persons aged 65 or over living alone has been rising for both sexes, and the percentage living with family members other than a spouse (e.g., children, other relatives) has been declining. At the same time, the percent of older persons residing in institutions has remained low and fairly constant (at about 5 percent). There has been a major change during the last few decades, however, in the leading types of residential institutions; public old-age homes and mental hospitals have been replaced by private nursing homes. The United States tends to be exceptional in the percentage of older persons residing in institutions, even though the figure is low. Other countries, both in the MDR and LDR, rely less on group facilities and more on existing family structures for maintaining the frail elderly.

Ideally, older persons should be able to remain in the community as long as possible, with public and private social services and family efforts providing for their health and social needs. When an individual can no longer be maintained at home, in spite of home care services and gerontic day-care facilities, a nursing home, hospital geriatric in-patient service, or other institutional care may be needed.

The need for institutional care would seem to reflect an extreme health condition of the individual which calls for care wholly by others. This is largely true, but the play of numerous other factors, principally the economic status of the individual, the family status of the individual, and the availability of alternative arrangements with respect to housing and personal care, compromise this interpretation and hence distort international comparisons of social functioning as reflected in statistics on institutional care. Because practices regarding long-term care are influenced more by local policies and resources than by any universal indicators of the need for health and other services in the MDR, they vary widely. There is evidence that some of the aged whose health status would warrant institutional care are being cared for at home in countries where institutional facilities are available. Conversely, there is evidence that some of the elderly in these countries who are in institutions do not require institutional care. Little information of a comparative nature is available on the characteristics of the institutionalized elderly in different countries, however (Cohen, 1981; Taber, 1980).

The growth of private nursing homes for the aged in the MDR has been massive in the last few decades, even though this growth is now falling off. Although the nursing home was originally envisioned as a compromise between a hospital and a private housing unit, because of escalating costs and sometimes questionable benefits it has come to be viewed by many gerontologists as a very imperfect solution to the problem of growing dependency in old age. As noted, in some of the more-developed countries, particularly the United States, a relatively high proportion of the frail elderly lives in various types of nursing homes and other long-term care facilities, but in other more-developed countries, the proportion is much smaller and alternatives are employed to a considerable extent to obviate the need for institutional care.

These alternatives to nursing homes for the frail elderly include sheltered or congregate housing, "senior citizen" apartments, and home health services (e.g., nurses, meals, visitors). Many other alternatives have been proposed and implemented. One option is shared housing or living space where two or more unrelated older persons join together to establish a single household. Another is an arrangement where older persons work, eat, and meet socially at a communal center during the day and return to their own homes at night. Many factors would affect the options provided; among them are the health of the older persons, the geographical dispersion of the population, the family structure and kinship network, and the economic resources of the family and community.

With the rapid growth in the number of elderly, the increasing concentration of the population in urban areas, and the disintegration of the traditional extended family system in the more-developed countries, many of these countries have moved toward publicly supported programs of care of the elderly. Public alternatives have been developed because they are perceived as providing better health care, as being more cost-effective, or as filling a need not covered by relatives, neighbors, and private agencies for many frail elderly. The evidence certainly disputes this perception if it is a question of home care as opposed to institutionalization and if public financial support or incentives could be provided directly to families. Hence, social policies should favor providing various types of assistance directly to families for the care of their elderly members, possibly in the form of income maintenance schemes.

Until now, traditional family systems have provided the framework for the care of the aged in the LDR. The LDR have few or no facilities for long-term care of the elderly, primarily because of limited resources for this purpose but also because of cultural values that emphasize keeping elderly persons in the family setting (WHO, 1978a). Demographic and social changes similar to those in the MDR are now occurring at a rapid pace in many less-developed countries. Recognition of the profound changes that are occurring should alert the

Table 17. Familial Age-Dependency Ratios, by Number of Older Generations: 1960 to 2020

(Familial age-dependency ratios, or older-parent/adult-child ratios inversely relate a group of adult persons to the older population of appropriate parental ages. Projections are medium variant)

Region	One older generation[1]				Two older generation[2]			
	1960	1980	2000	2020	1960	1980	2000	2020
World	132.3	128.3	118.9	154.7	23.5	30.4	31.8	31.1
More-developed regions	181.9	170.3	177.2	250.4	30.6	48.9	46.9	51.6
Less-developed regions	107.5	108.5	99.9	134.4	17.6	19.6	23.9	24.0
Africa	91.7	96.0	96.8	95.8	14.2	15.0	18.4	23.3
East Asia	119.0	133.0	117.4	209.3	16.4	24.0	32.3	30.7
South Asia	105.2	91.1	94.8	113.2	20.7	15.4	16.3	19.6
Northern America	153.5	213.2	127.6	251.6	35.6	43.4	55.2	35.2
Latin America	100.1	113.8	98.8	125.0	19.8	27.8	34.0	30.7
Europe	219.0	191.4	196.5	267.5	30.3	54.9	50.1	56.0
U.S.S.R.	165.7	125.2	175.4	215.8	29.2	52.3	39.6	55.2
Oceania	138.8	167.0	133.2	198.2	31.3	34.0	43.0	36.0

[1] $\frac{\text{Population 60 to 74 years}}{\text{Population 40 to 44 years}} \times 100$

[2] $\frac{\text{Population 80 years and over}}{\text{Population 60 to 64 years old}} \times 100$

Source: Based on United Nations, Demographic Indicators of Countries: Estimates and Projections as Assessed in 1980, Population Studies, Series A, No. 82, United Nations, New York, 1982.

appropriate government agencies to the need to maintain the traditional social institutions since they could play a vital role in protecting the health and welfare of older persons in the LDR.

At the same time, some of the experiences of the MDR with regard to living arrangements and housing of the elderly may possibly be instructive to the LDR. Some of the proposed alternatives to nursing homes in the MDR may be more appropriate than others for those less-developed countries that are experiencing a rapid growth in the number of older persons who lack family support. Such issues have been emerging in the LDR only recently. To consider this question and related ones, the Council on European Studies and the U.S. Administration on Aging sponsored an international symposium on alternatives to nursing home care for the frail elderly and a report on this symposium has been published (Taber, 1980).

Familial dependency and multigenerational families. Ratios of elderly parents to adult children for various countries and regions provide an indication of the international variation in the support burden within families. This variation can be measured roughly by familial dependency ratios, computed as the number of persons 60 to 74 years of age per 100 persons aged 40 to 44.* Because fertility rates and mortality rates are higher in the LDR than the MDR, these ratios tend to be much lower in the LDR. In 1980 the elderly-parent/ child ratio for the LDR (109) was only 56 percent of the elderly-parent/child ratio for the MDR (170) (table 17). The elderly-parent/child ratio varies from a regional low of 91 in South Asia to a regional high of 213 in Northern America. On the average, the ratios for the MDR are expected to rise slightly, and the ratios for the LDR to fall slightly, between 1980 and 2000, but the essential pattern of regional variation is expected to remain. These differences in the direction of the change of the elderly-parent/child ratios principally reflect differences in growth rates for the age group 40 to 44—high growth rates for the LDR and low growth rates for the MDR.

Alternatively, we may ask, how do levels and changes in fertility and mortality affect the relative burden of families in providing for the elderly in the different regions? According to a study by Goodman et al., for countries with high fertility and relatively low mortality (i.e., countries in the demographic transition), each mother has more than twice as many adult daughters alive (2.8 children when the mother is 60 years of age) as after fertility has fallen (i.e., after the demographic transition), when each mother will have only about one daughter alive (1.2 children when the mother is 60 years of age) (Goodman, Keyfitz, and Pullum, 1979). In the former case the extended family can still function well, but it is not likely to be functioning in the latter case. In the low fertility countries, the chance of a daughter 45 years of age having a living mother is high (0.69) and remains high even at 55 (0.44); the corresponding probabilities are only moderately lower for the high fertility countries with declining mortality (0.61 and 0.36).

The responsiblity of caring for an aged parent is easier to bear when resources are adequate, there are several adult children, and few persons survive to old age. In many of the less-developed countries, there may be several adult children and relatively few persons survive to old age, but family resources are scarce. Given the very limited government resources available for providing health and welfare services to the older population in the LDR, low elderly-parent/child ratios benefit the LDR's older population.

Familial dependency ratios and similar measures may be used to support the view widely held in the LDR that the more children parents have sired, the greater the likelihood that at least one son will survive who will care for the parents in later

*These age groups inversely relate adult children 40 to 44 years of age to the most common ages of their parents. When the younger group was under 5, the older group was 20 to 34.

life. Empirical research challenges the merit of the argument that filial support of the aged is a reasonable motivation for producing many children in the LDR, however. A study in rural India showed that the children are able to contribute little financial support to their elderly parent(s) and that the economic status of the oldster may be determinative (Vlassoff and Vlassoff, 1980).

Alternatively, it may be hypothesized that the introduction of old-age security programs in the LDR could have the effect of eventually reducing fertility and also reducing the support burden of older parents on children (Entwistle and Bollen, 1981). While no evidence exists that the introduction of old-age security programs caused fertility to begin declining in countries that experienced fertility declines over the past century (Kelley, Cartright, and Hittle, 1976), there is evidence that such programs may contribute to the continuation or intensification of fertility declines once the programs become established (Hohm, 1975; Hohm, 1976).

Increasingly because of the very high longevity achieved in many of the more-developed countries, the parents of elderly persons are still alive. This phenomenon is far more common in the MDR than the LDR, as indicated by familial dependency ratios relating persons 80 years of age and over to persons 60 to 64. The comparative figures for the MDR and LDR are 49 and 20 (per 100), respectively (table 17). These ratios are consistently high in Northern America, Europe, and the U.S.S.R. and consistently low in Africa, Asia, and Latin America. In Europe, in 1980, for every 100 persons 60 to 64 years, there were an estimated 55 persons 80 years and over, but in Africa for every 100 persons 60 to 64 years, there were only 15 persons 80 years and over. The general tendency is for the ratio to rise in the LDR and to fall in the MDR in the next 20 years. Subsequently, the ratio in the MDR, particularly, exhibits a marked rise. The pattern of change in Northern America deviates sharply from the general pattern for the MDR because of its considerable fertility variations since World War I. "Older" families with parents of extreme old age may have an excessive burden to carry. For example, a retired individual or couple may be trying to stretch limited physical, financial, and psychic resources to cover the aged parent or parents. In addition, they may be trying to provide some financial support to their children, perhaps for advanced education or the purchase of a first home.

The very high longevity achieved in many of the more-developed countries has resulted also in the emergence of the multigenerational family as a common phenomenon in these countries. Families having four generations in lineal descendency or ascendency (not necessarily occupying the same housing unit) are becoming numerous in the countries with the lowest mortality levels. All of these four-generation families have one or more elderly members and many have elderly members of two generations, with surviving octogenarians or nonagenarians who live with children in their 60's or older. Since childbearing begins at an earlier age in the LDR, great-grandparents in the LDR may typically be younger than in the MDR. Nevertheless, higher mortality keeps many more persons from becoming great-grandparents in the LDR than in the MDR.

Data on the distribution of families by number of generations are not available. A very rough indication of the comparative tendency for countries to have multi-generation families with two older generations is given by comparing the ratios of persons 80 years of age and over to persons 60 to 64 years of age for major regions, cited above. Another rough indication of the comparative tendency for four-generation families is given by relating the percent of the population 65 years and over in the LDR to the percent of the population 70 years and over in the MDR. On this basis, the LDR are only about half as likely to have four-generation families as the MDR, and Africa is only about one-third as likely to have such families as Europe.

Size of family and longevity. Childless and 1-parity women and women of parity 4 and higher, especially if they are over 35, tend to have higher mortality than women who have had 2 or 3 children. (Parity relates to the number of children women have had.) Childlessness in the past has often been the result of health impairments or health considerations. It appears to be associated with an increased risk of developing breast cancer. Multiparous women have increased risks of obstetric complications, cancer of the cervix, and diabetes. In the LDR, recurrent pregnancy and lactation may result in a substantial drain on the nutritional reserves of mothers, particularly for women with inadequate diets, a condition known as "maternal depletion syndrome" (Hansluwka, 1974).

Most studies on the relation between longevity and parity of women are limited to low mortality, developed countries. The type of association between size of family and longevity just described has been demonstrated for women in the United States (Kitagawa and Hauser, 1973). Among ever-married white women aged 45 to 64 in the United States, mortality ratios standardized for age and education show a marked J-shaped pattern as the number of children ever born increases, with above-average mortality for women who have had 5 or more children. Thus, very high fertility per se, independent of socioeconomic status, may reduce a women's longevity. Mortality ratios at ages 65 and over tend to show a J-shaped pattern as the number of children ever born increases, but there are fluctuations in the data, reflecting problems of reporting, recall, and other factors. The mortality ratios for women with no children up to 5 or 6 children fluctuate from 95 to 103, but for women with 7 or more children the mortality ratio is 106.

Women surviving to the older ages have a greater-than-average chance to be mothers of intermediate-size families, given the greater mortality of the lowest and highest parity women and the greater fetal and infant mortality of first births and very high order births. The greater-than-average mortality of never-married women also supports this generalization. In general, then, the health and longevity of women are enhanced by mothering a moderate number of children. While the evidence for this conclusion is derived from studies in the

Table 18. Per Capita Gross National Product in Relation to Expectation of Life at Birth for Selected Countries: 1980

(Includes countries with estimated populations of 1 million or more, excluding countries for which data on both variables are lacking)

Per capita gross national product (U.S. dollars)	Life expectation at birth								
	All countries	Under 45 years[1]	45 to 49 years	50 to 54 years	55 to 59 years	60 to 64 years	65 to 69 years	70 to 74 years	75 years and over
All countries	117	15	19	12	10	15	11	29	6
Less than $200	8	6	1	1	-	-	-	-	-
$200 to $399	20	5	8	5	-	-	2	-	-
$400 to $599	15	4	6	2	2	1	-	-	-
$600 to $999	9	-	2	2	3	2	-	-	-
$1,000 to $1,999	19	-	2	1	3	9	1	3	-
$2,000 to $2,999	9	-	-	-	-	2	4	3	-
$3,000 to $4,999	13	-	-	-	1	-	3	8	1
$5,000 to $9,999	10	-	-	-	1	-	-	8	1
$10,000 and over	14	-	-	1	-	1	1	7	4

[1]No countries with life expectation at birth under 40 years are included.

Source: Based on Population Reference Bureau, Inc., 1982 World Population Data Sheet, April 1982, Washington, D.C.

MDR, it may be tentatively extended to the LDR also and represents an important additional reason for support of family planning services in the LDR and among the extreme poor of the MDR.

Other Socioeconomic Factors

Economic development: Per capita gross national product or income. We consider next the relation of longevity to such economic factors as national per capita income or gross product, socioeconomic status of individuals within countries, and economic activity and retirement. We look also at regional variations in the economic dependency of the older population as an indicator of the relative need for health and other services on the part of older persons and the relative ability of society to provide them. First, it is useful to examine the economic background in general terms.

The rate of economic growth in the world continues to outpace the rate of population growth, and levels of per capita income have risen over the years in the LDR as well as the MDR. On the less global level, however, the economic advance is unsteady and uneven among countries. Progress is hampered by economic stagnation, even reversals, in some areas. At the same time gross inequality persists in the distribution of income and wealth among countries and within countries.

A wide gap exists between the per capita income of the MDR and the LDR, although perceptible progress has been made in narrowing the gap since World War II. The disparity appears to have widened in the last decade or so, however. There are also enormous inequities among countries within the less-developed group, and these differences, too, have increased in recent decades. Extreme, hopeless poverty and chronic hunger are the lifetime lot of hundreds of millions of people in the economically least-advanced countries (*People*, 1982) and, yet, it is there that population continues to multiply most rapidly.[7]

A low national per capita income level or gross national product per capita is associated among countries with high mortality levels and low expectation of life (table 18) (WHO, Chao, 1981; WHO, Silver, 1981). Life expectation tends to rise as national per capita income rises, although China appears to be an important exception. The relation between national per capita income and life expectancy among countries is nonlinear, however, with life expectancy showing sharply diminishing increments as income increases. In predicting life expectation, a per capita income of $750 seems to be a critical amount (United Nations, 1980). Large differences in life expectation exist between the countries with per capita incomes on the two sides of that line. Countries with very low per capita incomes are particularly vulnerable. We could include here countries with a per capita income in 1975 below $175, such as Bangladesh, Ethiopia, India, Zaire, and numerous other less-developed countries of smaller population size, many of them in Africa.

Socioeconomic differentials. Mortality rates are highly sensitive to individual income levels, independent of the national level of economic development. Studies of mortality differences among individuals distinguished by social or economic class in countries as disparate as India and the United States consistently reveal lower mortality rates among the "upper" classes (WHO et al., 1980; Kitagawa and Hauser, 1973). Socioeconomic differentials in mortality within

[7]The United Nations has designated some 32 countries as Least Developed Countries (LDC), among them Afghanistan, Bangladesh, Ethiopia, Nepal, Sudan, and Tanzania. The LDC are defined by very low income per person, low levels of adult literacy, and low output of manufactured goods. For the LDC as a group, income per person is under $200 per year and illiteracy is over 75 percent.

countries persist in spite of the decline in mortality of whole populations. This is true both in the LDR and the MDR. The resistance to the disappearance of class differences in mortality suggest that fundamental changes in society would be necessary to eliminate them (WHO et al., Bourgeois-Pichat, 1980; WHO et al., Antonovsky, 1980).

In analyzing the relation between socioeconomic status and mortality, separate consideration should be given to the role of social and economic factors, distinguishing, for example, educational level from income. Such indicators as educational level or literacy may be viewed as a component of social development, while such indicators as per capita income or per capita gross national product reflect the stage of economic development. There is evidence that mortality responds more closely to educational level than to income, but much of this evidence is based on cross-national studies of child mortality rather than national studies of adult mortality.

Education influences health in several ways. It affects one's attitudes toward the use of health and health-related resources. It implies more or less knowledge of personal hygiene and of health resources and influences one's awareness of the need and of the right to use the available health resources. Finally, education influences one's practice of personal hygiene, one's utilization of health and health-related resources, and one's involvement in community health activities.

It is not surprising, therefore, that mortality varies according to educational level. In fact, variations in mortality according to educational level are characteristic of the countries in both the more-developed regions and the less-developed regions. Numerous research studies have been carried out demonstrating an inverse relation between educational level and child mortality. These studies tend to indicate that education is an influence in health independent of income and even of the availability of health facilities. Much less is known about the relation of educational level and the mortality of adults, especially the elderly.

In a comparison of the mortality of the States of Kerala and West Bengal in India, Nag concluded that a major factor in the lower mortality of Kerala was the higher literacy, particularly among females (Nag, 1978). In more general terms, higher levels of social development, in addition to more favorable environmental and hygienic conditions, can explain the lower level of mortality in Kerala.

Behm et al., have analyzed the risk of death between birth and 2 years of age in 12 Latin American countries in relation to the education of the mother (WHO et al., Behm, 1981). It was observed that the risk of death of a child in this age declines steadily, and life expectation at birth rises steadily, as the education of the mother increases. Furthermore, the variation found in urban and rural mortality in Latin America can be explained almost exclusively by differences in the socioeconomic structure of each type of area when the level of education of the mother is used as a surrogate measure of socioeconomic status. Within each educational category, the range of differences between urban and rural childhood survival nearly disappears (United Nations, 1980). On the basis of an analysis of data from the 1960 Census of Ghana, Caldwell reported very large differences in birth survivorship according to the education of the mother (WHO et al., Caldwell, 1980). In a United Nations study of 115 countries, the correlation between literacy and expectation of life at birth was higher than for any other specific factor considered (WHO, Granahan et al., 1974).

According to an analysis by Kitagawa and Hauser, in the United States in 1960 there were pronounced differences in mortality according to educational level both for persons over age 65 and persons under age 65 (Kitagawa and Hauser, 1973). White females aged 65 and over of lower education (less than 5 years of school) experienced 67 percent higher mortality than women with higher education (4 years of college). White females 25 to 64 years of age, of lower education, experienced mortality 105 percent above that of women with higher education. At age 25, women with at least 1 year of college could expect to live at least 10 years longer on the average than women with less than 5 years of school. Education exerts an influence on mortality independent of income. The educational differential in mortality for white females aged 25 to 64 was reduced only from 51 percent to 36 percent when income was held constant.

Economic activity and economic dependency. Continued participation of older persons in economic life is viewed as salutary for the individual and for the society. The main advantage is that economic dependency is reduced. The need for economic support by the family, community, and State is essentially obviated if the older person continues to be economically active. If the person is inactive, at least part of the burden will rest on the State.

Regional variations in economic activity ratios (i.e., the proportion of the population that is economically active) at the older ages are considerable, particularly for males. In 1980 economic activity ratios for males 65 years old and over in Northern America and Europe approximated 20 to 22 percent, while the corresponding figures for Latin America, Asia, and Africa were nearly twice as great or greater, varying from 42 percent for Latin America to 58 percent for Africa (table 19). The range for individual countries is much wider, varying, for example, from 12 percent for France to 63 percent for Kenya.

The activity ratios for females 65 years old and over are far lower but still vary widely. Europe, Latin America, and Northern America have ratios in the vicinity of 6 to 8 percent, while the ratios for Africa and Asia are in the vicinity of 16 to 19 percent.

Different levels of economic activity at the older ages imply different proportions of persons retiring at these ages and different levels of economic dependency of the older inactive population on the working population. Retirement tends to occur at a much earlier age in the MDR than the LDR and, at least in the MDR, average age of retirement appears to have been falling as pension plans have been extended and made more dependable.

Aged economic dependency ratios, that is, ratios of economically inactive older persons (45 years and over) to

the economically active population, reflect both the age distribution of the population (demographic component) and the pattern of economic activity ratios (economic component). These two factors combine to produce far higher aged economic dependency ratios in the MDR than in the LDR (table 20 and figure 7). For example, this ratio (per 100) was about 43 in Europe and about 15 in Africa in 1980. Since the economic dependency ratios of the young (under 45 years) in the LDR and the MDR differ in the opposite direction from the economic dependency ratios of the aged, the total economic dependency ratios of the regions tend to vary much less from one another than the corresponding aged economic dependency ratios. The total economic dependency ratios (per 100) for Africa and Europe in 1980 were about 171 and 123, respectively.

Over the next few decades, activity ratios for the older population in all regions are projected to decline while activity ratios for young adults and middle-aged adults, particularly women, are projected to rise. During the same period, shifts in age distribution will add to the dependency burden of older persons. Aged-dependency ratios (persons 60 years and over per 100 persons 15 to 59 years) will grow slowly or moderately in most regions, however (table 14). Then, in the first quarter of the next century, they will rise sharply in several regions, namely, Northern America, Europe, and, East Asia. In East Asia, for example, there will be one elderly

Table 19. Economic Activity Ratios for the Population 55 to 64 Years and 65 Years and Over, by Sex: 1960, 1980, and 2000

(Economic activity ratios represent the proportion of the population in any age group that is economically active. The classification according to more-developed regions and less-developed regions follows an earlier classification of the United Nations which places Southern Africa and Temperate South America as well as Japan, Australia, and New Zealand in the more-developed regions. Economic activity ratios for 1980 and 2000 are projected according to the medium variant)

Region	55 to 64 years						65 years and over					
	Male			Female			Male			Female		
	1960	1980	2000	1960	1980	2000	1960	1980	2000	1960	1980	2000
World	86.1	79.9	74.5	35.4	33.1	31.4	50.3	36.0	27.1	16.7	10.9	8.3
More-developed regions	83.3	73.9	69.1	33.6	32.8	34.9	35.2	21.1	16.9	13.9	7.1	6.3
Less-developed regions	88.3	83.2	77.1	37.0	33.3	29.6	64.1	48.8	33.6	20.0	15.6	10.0
Africa	93.2	88.6	83.3	38.9	36.7	33.1	72.1	58.0	42.8	22.8	18.6	13.3
East Asia	95.7	80.9	74.8	42.4	40.8	38.2	57.3	42.9	29.2	22.7	17.7	11.6
South Asia	90.0	85.3	79.1	34.7	30.8	27.5	68.2	54.5	37.6	17.7	13.9	9.2
Northern America	85.3	79.2	75.7	35.6	44.2	48.1	32.0	22.5	18.8	10.2	8.3	7.5
Latin America	86.4	78.1	72.6	[1]15.5	[1]15.2	[1]15.3	61.0	41.6	28.5	[1]9.5	[1]6.4	[1]4.7
Europe	82.7	75.2	70.8	29.4	32.1	34.2	33.1	19.9	15.4	9.9	7.2	6.4
U.S.S.R.	81.3	85.1	51.8	41.3	17.6	16.6	39.0	9.5	7.2	26.8	3.3	2.5
Oceania	85.9	82.4	78.7	20.4	25.8	27.5	31.6	23.7	19.9	5.4	5.0	4.5

[1]Women employed in agriculture are not included in the economically active population.

Source: International Labor Office, Labor Force Estimates and Projections, 1950-2000, Geneva, 1977, table 2 (1960) and table 5 (1980, 2000).

Table 20. Economic Dependency Ratios for the Older and Younger Populations: 1960, 1980, and 2000

(Economic dependency ratios represent the ratio of inactive population per 100 active population. The classification according to more-developed regions and less-developed regions follows an earlier classification of the United Nations which places Southern Africa and Temperate South America as well as Japan, Australia, and New Zealand in the more-developed regions. Economic dependency ratios for 1980 and 2000 are projected according to the medium variant)

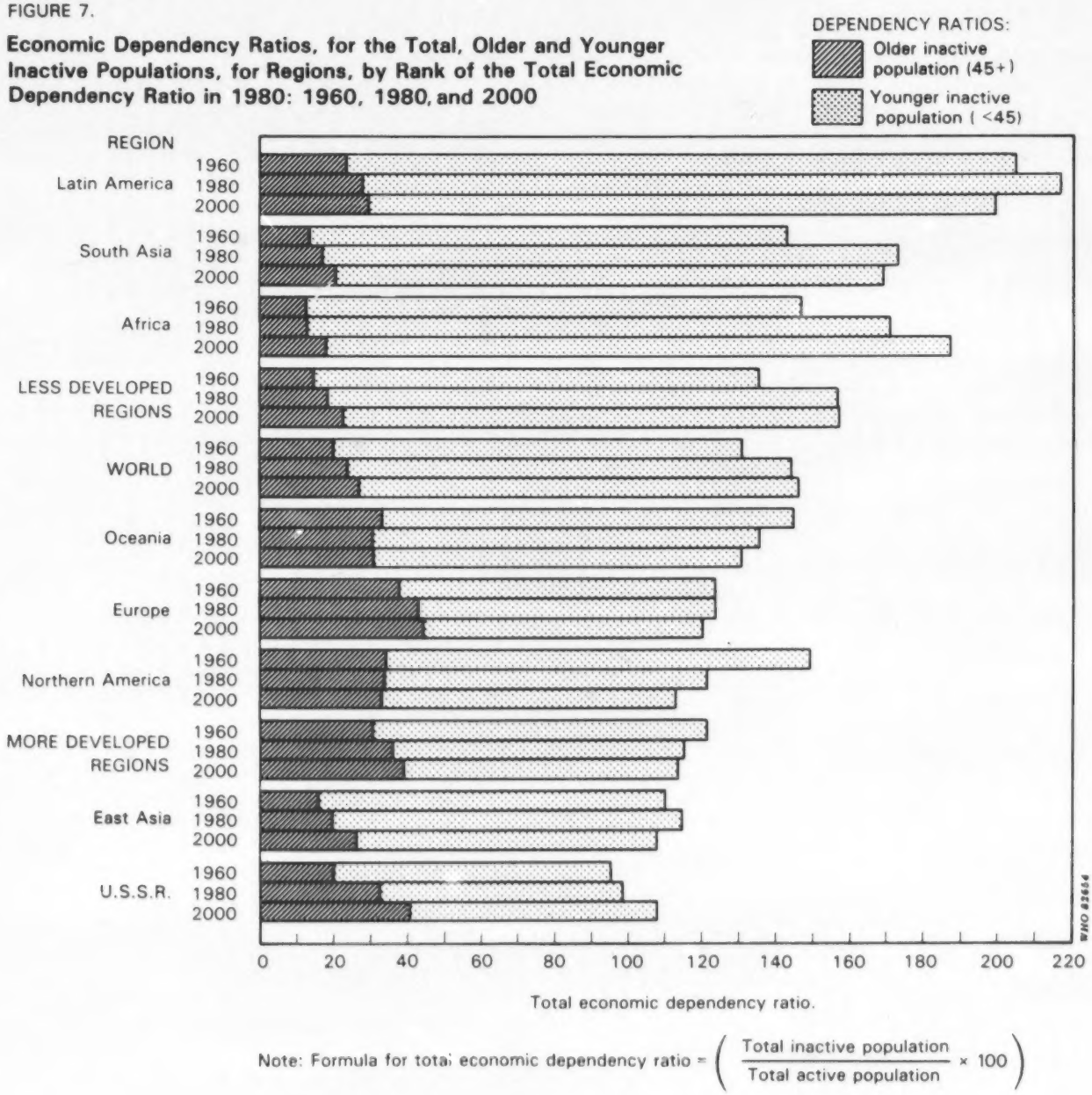
Region	Total inactive population[1]			Older inactive population[2]			Younger inactive population[3]		
	1960	1980	2000	1960	1980	2000	1960	1980	2000
World	130.3	143.8	145.8	20.0	23.6	26.7	110.3	120.2	119.1
More-developed regions	120.9	114.8	113.0	30.5	35.8	39.0	90.3	79.0	74.0
Less-developed regions	135.1	156.6	156.7	14.5	18.2	22.5	120.6	138.4	134.2
Africa	146.8	170.7	187.1	12.6	14.9	18.0	134.2	155.9	169.2
East Asia	109.7	114.2	107.3	15.6	19.6	26.0	94.2	94.7	81.2
South Asia	142.6	172.8	169.1	13.3	16.9	20.7	129.3	155.9	148.4
Northern America	148.6	120.9	112.3	34.1	33.5	33.0	114.5	87.4	79.2
Latin America	204.6	217.5	199.0	23.6	27.6	29.4	181.0	189.8	169.6
Europe	122.9	122.9	120.0	37.6	42.7	44.2	85.2	80.2	75.6
U.S.S.R.	94.8	98.2	107.5	20.0	32.2	40.2	74.8	65.9	67.3
Oceania	144.4	135.1	130.5	32.9	30.5	30.7	115.5	104.6	99.8

[1]Total inactive population per 100 active population.
[2]Inactive population 45 years and over per 100 active population.
[3]Inactive population under 45 years per 100 active population.

Source: Based on International Labor Office, Labor Force Estimates and Projections, 1950-2000, Geneva, 1977, table 2 (1960) and table 5 (1980, 2000).

FIGURE 7.

Economic Dependency Ratios, for the Total, Older and Younger Inactive Populations, for Regions, by Rank of the Total Economic Dependency Ratio in 1980: 1960, 1980, and 2000



Note: Formula for total economic dependency ratio = $\left(\frac{\text{Total inactive population}}{\text{Total active population}} \times 100 \right)$

Source: Year 2000.

dependent for each four persons of "working age" in 2020, as compared with one in seven in 1980 and one in six in 2000. The slower growth in aged-dependency ratios during the remainder of this century should facilitate adjustment to the dependency problem in anticipation of the more rapid changes to follow in the next century. Changes in aged-dependency ratios will be reflected in changes in economic dependency ratios. In fact, the demographic component is expected to dominate economic dependency ratios and the economic component will only intensify the age dependency effect.

The economic dependency situation of older men and older women is quite different, especially in the LDR. The ages of optional retirement are usually lower for women than for men and, as was noted, economic activity ratios at the older ages are far lower for women. In 1975, for example, the aged economic dependency ratio was 22 for men and 123 for women in Africa, and 136 for men and 347 for women in Western Europe. The gap should narrow in the future since activity ratios for men are expected to fall faster than for women. The economic security of older women is a special problem because they are far less likely to have worked and are very likely to be widowed.

The practical and policy aspects of old-age dependency relate to the possible costs, the need for government intervention, and the relative contribution of the family, the local community, and State to the total cost. The public cost of supporting an older person is likely to be greater than the public cost of supporting a child, mainly because children are largely supported by their families and the oldsters may not be, especially in the MDR. Since the number of elderly persons is expected to rise in both the MDR and the LDR, the total costs of supporting the elderly will rise in both types of areas. Reductions in fertility rates will aid in offsetting the costs of old-age dependency in the LDR but there is little room for substantial fertility reductions in the MDR. The level of activity ratios may be crucial in affecting costs in the MDR since in these areas the proportions of elderly persons and the relative costs of supporting an old person are both high.

The patterns of economic activity and retirement have a considerable bearing on the capacity of a society to support health services for the elderly. Declines in activity ratios and early retirement tend to reduce the number of active older persons and add to the number of inactive older persons; hence they contribute doubly to the economic dependency burden of older persons. Since economically active persons contribute to the public funds for support of the elderly and inactive persons draw from the funds, any postponement of retirement has a double effect on public finances, both adding to the years when contributions are made and reducing the years when benefits are received.

There are other interrelationships between health and economic activity of the elderly. Ill health may prevent economic activity or induce early withdrawal from the economically-active population. Some studies suggest that poor health may be the most important reason for early retirement in the MDR; others emphasize the readiness of workers to take advantage of the pensions available to them at the earliest age. Some types of occupations are responsible for excessive mortality, either because they are stressful or are physically hazardous.

Physical Factors. Since aging may be defined in terms of greater physiological vulnerability to the stresses of the "external" and "internal" environment, it is a virtual corollary that the older population would be more adversely affected by inadequacies or extremes in the physical environment. Aspects of that environment of special importance with respect to health are air quality, water supply and quality, sewage disposal, and the quantity and variety of food.

There is evidence of excess mortality, particularly of older people, when air pollution levels rise sharply in specific places. With the more widespread use of motorized transportation and growing industrialization in the LDR, pollutant levels are rising in the large cities of the LDR. Some are especially affected, such as Mexico City, Cairo, and New Delhi. These conditions may be expected to exercise a progressively adverse effect on the health of the population of these areas, especially the older population, imposing restraints on the effect of factors favorable to health. There is evidence also of exceptional longevity and superior health among older persons in some rural mountainous areas (e.g., the Vilcabambans, Hunzas). The other factors, such as a lifetime of heavy physical exercise and moderate diets consisting mainly of fresh garden foods, confound the picture with regard to the role of air quality, however.

Abysmal conditions of water supply and sewage disposal continue in many less-developed countries although the conditions have markedly improved in recent decades (World Health Organization, 1973). The situation is far poorer for rural populations than for urban populations. In 1970, only 12 percent of rural LDR populations had "reasonable access" to a community water supply (public fountain or standpipe within 200 meters of a house) and only 8 percent of the rural LDR population was judged to have adequate sewage disposal. Lack of an adequate water supply and sewage disposal system may explain why diarrheal disease continues to be a relatively prominant factor in the mortality picture of the LDR.

Mortality from several diseases is related to food supply, including both the quantity and kinds of food available. Food shortage and widespread malnutrition and undernutrition are recognized as major obstacles to mortality declines in sub-Saharan Africa and in other less-developed parts of the world where similar conditions exist. A more distressing problem is the maldistribution of the food supply. Many persons are deprived of adequate food even in countries where national food supplies exceed per capita requirements.

In many less-developed countries, food production actually fell behind population growth during the 1970's. As a result, an already dire situation associated with inadequate daily food supplies was exacerbated. Of even greater effect on the health of the population was the increased deficiency of average daily caloric consumption in relation to nutritional requirements in the regions with the poorest food supplies

(International Union, 1978: Chowdhury and Chen; Keys, Sukhatme). Diminshing per capita food production and inflation of food prices in many African countries have intensified the deprivation of the vast lower-income strata of the population.

Of many linkages between food supply and mortality, probably the most important are those between nutritional status and influenza/pneumonia/bronchitis, diarrheal diseases, and respiratory tuberculosis. The cause-effect mechanisms are not well known, but it appears that protein malnutrition impairs the production of antibodies in response to bacterial and viral antigens and that undernutrition can produce atrophy of the organs responsible for the immune response. There is now also extensive evidence that infectious diseases themselves are an extremely important source of malnutrition, independent of the person's nutritional state at the time of attack. Infection increases metabolic demands on the body, and often reduces the absorption of nutrients and increases their excretion. Absorption of nutrients can also be reduced by nausea and diarrhea, or, more drastically, through customs denying food to the sick.

The impact of malnutrition, undernutrition, and food deprivation on mortality is distributed very unequally among different age groups in a society. Older persons are particularly affected by food deprivation. Mortality among the elderly rises sharply during a famine period and remains for awhile above previous levels after the famine period because of the weakened physiological conditions of most people (Bongaarts and Cain, 1981).

Although the degree of the inadequacy of diets in many areas of the world today is rather severe, it is quite possible that the severity of the problem will increase in the future. If this possibility is realized, mortality levels may increase, especially in the most vulnerable age categories, the elderly and the very young.

Health personnel. The little information on personnel in geriatric services available indicates a severe shortage of professionals of this type. The limited number of persons in geriatric services reflects the general problem of severe shortages of health manpower in all specialities in many countries of the world, especially the rural parts of these countries. The supply of qualified health professionals is often woefully inadequate in the LDR, and the situation may be deteriorating as a result of a relative excess of population growth over the increase in the supply of qualified manpower. For example, it has been estimated that in 1975, 40 percent of the population of Latin America, and an even greater proportion of the rural population of that region, had no medical or health care services at all (Pan American Health Organization, 1980). Table 21 present information on personnel per capita for the countries of this region and illustrates the very wide variation from country to country in the availability of health personnel.

A strategy in the Chinese People's Republic places reliance on the "barefoot doctor" program and other special measures to confront the tremendous current need for health service professionals, the imbalance between population growth and

Table 21. Medical Personnel, by Type, per 10,000 Population, for the Countries in Latin America: Around 1976

Country	Physicians		Registered nurses		Other medical personnel[1]
	Ratio	Year	Ratio	Year	Ratio
Argentina	21.7	1973	5.9	1973	10.4
Bahamas	6.8	1976	16.8	1976	18.7
Barbados	6.7	1976	25.5	1976	15.7
Bolivia	4.7	1974	1.6	1972	1.7
Brazil	6.1	1972	0.8	1972	9.7
Chile	4.5	1976	2.6	1976	20.6
Colombia	4.8	1973	1.4	1977	11.0
Costa Rica	6.6	1975	5.6	1976	21.0
Cuba	8.9	1974	10.1	1977	14.4
Dominican Republic	5.4	1973	0.7	1976	5.5
Ecuador	4.7	1973	1.7	1977	10.6
El Salvador	2.7	1976	2.9	1976	6.1
Guatemala	2.2	1971	1.4	1971	6.8
Haiti	0.9	1976	1.1	1976	3.8
Honduras	3.4	1976	1.3	1976	12.7
Jamaica	2.8	1974	14.3	1974	4.7
Mexico	8.0	1974	4.6	1974	8.2
Nicaragua	6.3	1975	2.4	1972	9.8
Panama	7.9	1976	6.9	1976	15.1
	4.6	1976	1.7	1976	6.7
	5.6	1972	4.6	1977	7.3
	11.5	1974	16.6	1974	17.8
	11.0	1972	3.4	1971	20.4
	11.5	1976	7.4	1975	15.9

ers to same year as for registered nurses.

Source: Pan American Health Organization, Regional Strategies of Health for All by the Year 2000, Report CD 27/34A, 1980.

the increasing requirements for health service professionals, and their geographic maldistribution (Population Information Program, Johns Hopkins University, 1982). Since it is impossible to have a qualified medical doctor in every town or village, the government has tried to place at least one paramedical worker in each community, however remote. In China there are 1.46 million "barefoot doctors," who are trained paramedical workers, as compared with 0.4 million college-graduated physicians and 0.4 million nurses. In addition, there are middle-level physicians, practitioners of traditional medicine, and part-time health aides.

Similarly, there is the need to expand health facilities greatly in the LDR, such as by establishing primary health care clinics, offering informal ("off the street") health care services, staffed by paraprofessional health workers. These health clinics should be complemented by mobile health units offering both preventive and theraputic services. In India, for example, mobile units are equipped to perform rapid cataract surgery in virtual assembly-line fashion. Other mobile units periodically bring food to the countryside and village.

Some General Implications for Health Care of the Elderly

Various research studies show that the health needs of older persons are greater than those of other age segments of the population, as is their utilization of health services (Shanas and Maddox, 1976; U.S. Public Health Service, 1978). These health needs include many that are not met even now. Considered collectively, the health needs of the older population will grow even greater as their numbers increase. These developments will be exacerbated by the larger increases among the older aged than the younger aged anticipated at least for the next few decades; the former are particularly subject to chronic, debilitating diseases and are more likely to need long-term health care. It can be expected that the number of persons with severe disabilities will increase as more persons survive into the later years of life, although this trend may be offset in part by a reduction in chronic morbidity and disability rates at each age and in the severity of disabilities, particularly among the younger aged.

In the LDR especially, there is a serious problem in the effective availability of health care services at affordable prices. The task to be achieved in the LDR appears to be so great that there is a need for innovative approaches to the organization of health care. Several steps need to be taken. Governments should consider establishing a national system of primary health care facilities staffed by primary health care practitioners (World Health Organization, 1978; Joseph and Russell, 1980). This system would put emphasis on local paraprofessional health personnel and basic health care facilities, supplemented by mobile medical teams and facilities. At the same time, governments should avoid the allocation of scarce health resources to the purchase and maintenance of expensive medical equipment located in giant urban agglomerations (Berry, 1974; Hashmi, 1978.) There has been too much emphasis on acquiring the latest technical equipment requiring the most skilled health practitioners for its operation, for use in clinics and hospitals in the primate city.

Further, public policy must be formulated to direct or assign health personnel to locations where even minimal health services are lacking (Hashmi, 1978) and to support the financing of medical services on a salaried basis (Walsh, 1974; Berry, 1974). Although the evidence for regional and socioeconomic class differences in the health of the older population is unclear, it would appear that the prospects for improving the health of the elderly, especially in the LDR, would depend upon the implementation of policies which aim to reduce the inequality in the distribution of health resources to the various areas and various segments of the population. Policies aimed at correcting the urban-rural imbalance in the provision of health resources would contribute greatly to this end.

Because of the lack of trained professionals and the inadequacy of economic resources, the present pattern of rehabilitation services or its extension is unlikely to meet the needs of most countries in the foreseeable future in dealing with the problem of disability (World Health Organization, 1976). The existing services are, except in a few countries, grossly inadequate or services are almost nonexistent. A new philosophy of medicine is called for which recognizes that "disease-oriented medicine needs to be complemented by disability-oriented medicine" and that "the objectives of medicine are not only the prevention and cure of disease but also the optimum restoration of the individual to normal social functioning." New services have to be introduced aimed at reducing the global disability problem. It is estimated that half of all disability could be prevented or postponed utilizing currently known preventive measures. The emphasis of a new program should be on disability prevention and on providing services utilizing local personnel at the auxiliary level who would work within the framework of a system of primary health care. The best conditions for implementing a disability prevention program are to include it as part of the general community socioeconomic development program and to integrate it into the program of national health services.

Next, an enlightened public health policy for the LDR would support public programs to reduce both mortality and fertility simultaneously. Reductions in mortality without concomitant reductions in fertility would only tend to increase the number of children, and possibly also the proportion of children, in the population. The change in population structure would force the use of the greater resources for children and a reduction in those available for the elderly. The change in population structure, at least in the short run, would also militate against development goals measured in terms of educational levels, levels of living, and per capita product. Finally, there is a need for a strong commitment on the part of governments to the improvement of the health status of their populations. Goals for complete health care have to be translated into commitments of funds and, ultimately, into health personnel and facilities.

At the same time as a primary health care system is introduced or extended in the LDR, it is important not to wholly displace the system of traditional or folk medicine, where it has been the established system of health care, by "scientific" or "Western" medicine (WHO et al., Gaisie, 1980). Traditional medicine may prove more efficacious than modern medicine in the LDR in certain situations—certain types of populations (e.g., small tribal groups, rural areas, older age groups) and certain health conditions (e.g., psychosomatic illnesses).

The economics of health care in the LDR calls for special consideration because of its problematic nature. Since per capita income is usually very low in the LDR, much of the population in the LDR is undernourished, ill-housed, and poorly supplied with other material needs for healthy living. Adequate health services are beyond the means of most people, and most governments cannot afford to provide them. Under such circumstances, social and economic development is an indispensable key to the achievement of a regime of low mortality and an adequate program of health services.

The data given in this document underscore the fact that the problems relating to the provision of health and social services to the elderly cannot any longer be considered as issues of concern for a distant future. In many less-developed countries, the need for developing social policy and instituting measures for the elderly is becoming increasingly pressing. The well-being of the hundreds of millions of older people stand as a particular challenge to WHO's goal of Health for All by the Year 2000.

References

Arriaga, Eduardo A., and Kingsley Davis, "The Pattern of Mortality Change in Latin America," *Demography*, 6(3) 223 242, August 1969.

Belloc, Nedra B., and Lester Breslow, "Relationship of Physical Health Status and Health Practices," *Preventive Medicine*, 1:409-421, 1972.

Berkman, L.F., and S.L. Syme, "Host Resistance and Mortality: Nine-Year Follow-Up Study of Alameda County Residents," *American Journal of Epidemiology*, 9(2): 168, 1979.

Berry, Charles A., "The Impact of Emerging Technology on Health Care Systems," in Morris F. Collen (ed.), *Technology and Health Care Systems in the 1980's*, Proceedings of a Conference, January, 1972, San Francisco, U.S. Health Services and Mental Health Administration and U.S. National Center for Health Services Research and Development, Rockville, MD., 1974.

Bongaarts, John, and Mead Cain, "Demographic Responses to Famine," *Working Papers*, No. 77, November 1981, Center for Policy Studies, The Population Council, New York City.

Bonte, J.T.P., "Population Changes, Health, and Health Strategies in Developed Countries," 2.1.3:1-14 in *Conference on Economic and Demographic Change: Issues for the 1980's, Helsinki, 1978*, International Union for the Scientific Study of Population, Liege, 1980.

Bourgeois-Pichat, Jean, "La Deuxieme Conference Demographique Europeene de Strasbourg I. Le vieillissement des populations," *Population* (Paris), 27(2):209-239, March-April 1972.

_____, "La transition demographique: Vieillissement de la population," pp. 211-239, in *Population Science in the Service of Mankind. Conference on Science in the Service of Life, Vichy, 1979*, sponsored by the Institute of Life and the International Union for the Scientific Study of Population, Liege, 1979a.

_____, "Future Outlook for Mortality Decline in the World," pp. 227-266, in United Nations *Prospects of Population: Methodology and Assumptions* (Papers of the Ad Hoc Group of Experts on Demographic Projections, United Nations, New York, November 1977), Population Studies, Series A, No. 67, United Nations, New York, 1979b.

_____, "Essai sur la mortalite 'biologique' de l'homme," *Population* (Paris), 7(3):381-394, July-September 1952.

Burney, S.W., "Morbidity and Mortality in Healthy Aging Male Population: 10-year Survey," *Gerontologist*, 12:49-54, 1972.

Clogg, Clifford C., "The Effect of Personal Health Care Services on Longevity in an Economically Advanced Population," *Health Services Research*, 14:5-32, 1979.

Coale, Ansley J., *The Growth and Structure of Human Populations: A Mathematical Investigation*, Princeton University Press, Princeton, N.J., 1972, esp. chapters 1 and 8.

_____, "The Effects of Changes in Mortality and Fertility on Age Composition," *Milbank Memorial Fund Quarterly*, 34:79-114, 1956.

Cohen, Judith B., "Health of the Elderly of the World, Now and in the Year 2000," February 1981, unpublished manuscript prepared for the Pan American Health Organization and the World Health Organization.

Cowgill, Donald O., 'Aging of Populations and Societies," *Annals of the American Academy of Political and Social Science*, 415:1-18, 1974.

_____, "Demographic Aging and Economic Dependency," in H. Orimo, K. Shimada, M. Iriki, and D. Maeda (eds.), *Recent Advances in Gerontology*, Excerpta Medica, Amsterdam, 1979.

Day, Lincoln, H., *What Will a ZPG Society Be Like?* Population Bulletin, 33(3), June 1978, Population Reference Bureau, Washington, D.C.

Dwyer T., and B.S. Hetzel, "A Companion of Trends of Coronary Heart Disease Mortality in Australia, England and Wales, and U.S.A. with Reference to Three Major Risk Factors—Hypertension, Cigarette Smoking, and Diet," *International Journal of Epidemiology*, 9:65-71, 1980.

Entwistle, Barbara, and Kenneth A. Bollen, *Pension Programs in LDC's: An Indirect Means to Fertility Reduction?*, Research Reports No. 81-8, University of Michigan, Population Studies Center, 1981.

Espenshade, Thomas, and William Serow (eds.), *The Economic Consequences of Slowing Population Growth*, Academic Press, New York 1978.

Fries, James F., and Lawrence M. Crapo, *Vitality and Aging*, W.H. Freeman and Co., San Francisco, 1981, esp. Chapter 7.

Gendell, Murray, *Sweden Faces Zero Population Growth*, Population Bulletin, 35(2), June 1980, Population Reference Bureau Washington, D.C.

Goodman, L., N. Keyfitz, and T. Pullum, "Family Formation and the Frequency of Various Kinship Relationships, "*Theoretical Population Biology*, 5(1):1-27, February 1979.

Gwatkin, Davidson R., "Indicators of Change in Developing Country Mortality Trends: The End of an Era?," *Population and Development Review*, 6(4):615-644, 1980.

Hansluwka, Harald, "Health, Population, and Socio-Economic Development," Chapter VI in Leon Tabah (ed.), *Population Growth and Economic Development in the Third World*, Vol. I, International Union for the Scientific Study of Population, Liege, 1974, esp. pp 209-213.

_____, A. Lopez, and L. Ruzicka, "Some Implications of Demographic Prospects for Health Care in Countries of South and East Asia," WHO/ESCAP Meeting on Mortality in Asia: A Review of Changing Trends and Patterns, 1950-1975, Manila, December 1980.

Hashmi, Sultan S., 'The Impact of Prospective Settlement Patterns on Health Strategies in the 1980's in Less-Developed Countries," in *Conference on Economic and Demographic Change: Issues for the 1980's, Helsinki, 1978*, International Union for the Scientific Study of Population, Liege, 1978.

Hohm, Charles F., 'Social Security and Fertility: An International Perspective," *Demography*, 12(4): 629-644, November 1975.

_____, "Reply to Kelly, Cartright, and Hittle," Demography, 13 (4): 587-589, November 1976.

Hoogendoorn, D., "Enkele opmerkingen over de betekenis van de veroudering van de bevolking voor de gezondeheidszorg" (Some observations about the significance of the aging of the population for health care), *Netherlands Tijdschrift voor Geneeskunde*, 121(42), October 1977.

Hull, T.H., A.D. Lopez, and J.E. Rhode, "A Framework for Estimating Causes of Death in Indonesia," unpublished document, 1980.

International Union for the Scientific Study of Population, *International Population Conference, Manila, 1981*, Liege, 1981, See especially papers by:

Arriaga, Eduardo E., 'The Deceleration of the Decline of Mortality in LDCs: The Case of Latin America," pp. 21-50;

Azefor, M.N.A., "Counteracting Forces in the Continued Decline of Mortality in Africa," pp. 5-20;

Nightingale, Elena, 'Prospects for Reducing Mortality in Developed Countries by Changes in Day-to-Day Behavior, pp. 207-232;

Sivamurthy, Mathada, "The Deceleration of Mortality Decline in Asian Countries," pp. 51-76;

Susser, Mervyn,"Industrialization, Urbanization, and Health: An Epidemiological View," pp. 273-303.

International Union for the Scientific Study of Population, *International Population Conference, Mexico, 1977*, Vol. 1, Liege, 1978. See the following papers:

Chowdhury, A.K., M. Alauddin, and Lincoln C. Chen, 'The Dynamics of Contemporary Famine," pp. 409-426.

Keys, Ancel, "The Relationship Between Diet and Adult Mortality," pp. 427-438.

Suthatme, Pandurang, "Food Supply and its Demographic Implications," pp 357-369.

Joseph, Stephen C., and Sharon S. Russell, "Is Primary Care the Wave of the Future?" in *Medical Economics Special Issues: Health and Population in Developing Countries, Social Science and Medicine*, 14C(2), June 1980.

Kelly, William R., Philip Cartright, and David Hittle, "Comment on Charles F. Hohn's 'Social Security and Fertility: An In ternational Prospective,"*Demography*, 13(4): 581-586, November 1976.

Kitagawa, Evelyn M., and Philip M. Hauser, *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*, pp. 112-113 and 155-156, and Chapter 8, Harvard University Press, Cambridge, Massachusetts, 1973.

Kohn, Robert, and Ken L. White (eds.), *Health Care: An International Study* (International collaboration study of medical care utilization), Report of the World Health Organization, Oxford University Press, London , 1976.

Lightbourne, Robert Jr., and Shusheela Singh, with Cynthia P. Green, *The World Fertility Survey: Charting Global Childbearing*, Population Bulletin 37(1), March 1982, Population Reference Bureau, Washington, D.C., Table 7.

Medvedev, Z.A., 'Aging and Longevity: New Approaches and New Perspectives," *Gerontologist*, 15:196-201, 1975.

Morris, Morris David, *Measuring the Condition of the World's Poor: The Physical Quality of Life Index*, prepared by Over seas Development Council, Pergamon Press, 1979.

Morrison, Peter A., "The Future Demographic Context of the Health Care Delivery System," Rand Corporation, December, 1979.

Myers, George C., "Cross-National Trends in Mortality Rates Among the Elderly," *Gerontologist*, 18(5):441-448, 1978.

Nag, Moni, 'Impact of Social Development and Economic Development on Mortality: A Comparative Study of Kerala and West Bengal," *Working Papers*, 78, December 1978, The Population Council, Center for Policy Studies, New York City, p 42.

Omran, Abdul R., *Epidemiologic Transition in the United States: The Health Factor in Population Change*, Population Bulletin, 32(2), May 1977, Population Reference Bureau, Washington, D.C.

Organization for Economic Co-operation and Development, *Socio-Economic Policies for the Elderly*, Paris, 1979.

Palloni, Alberto, "Mortality Patterns in Latin America," *Population and Development Review*, 7(4): 623-645 December 1981.

Palmore, E.B., and V. Stowe, "Predictors of Longevity: Followup of the Aged in Chapel Hill," *Gerontologist*, 13:88-90, 1973.

Pan American Health Organization, *Regional Strategies of Health* for All by the Year 2000, Report CD27/34.A, 1980.

Parant, A., "Les personnes agees en 1975 et le vieillissement demographique en France (1931-1975)," *Population* (Paris), 33:381-410, 1978.

People, "Least Developed Countries," 9(2):3-7, 1982.

Pollard, John, 'Factors Affecting Mortality and the Length of Life," in *Population Science in the Service of Mankind: Conference on Science in the Service of Life, Vichy, 1979*, International Union for the Scientific Study of Population, Liege, 1979.

Population Information Program, Johns Hopkins University "Population and Birth Planning in the People's Republic of China," *Population Reports*, Family Planning Programs, Series J, No. 25, Jan-Feb, 1982, p. J-584.

Preston, Samuel H., 'Causes and Consequences of Mortality Declines in Less Developed Countries During the Twentieth Century," pp. 289-341 in Richard Easterlin (ed.), *Population and Economic Change in Developing Countries*, University of Chicago Press, Chicago, 1980.

_____ and J.A. Weed, "Causes of Death Responsible for International and Intertemporal Variation in Sex Mortality Differentials," *World Health Statistics Report*, 30(4):144-188, 1976.

_____ and V. E. Nelson, "Structure and Change in Causes of Death: An International Summary," *Population Studies*, 28 (1):19-51, March 1974.

_____ (ed.), *Biological and Social Aspects of Mortality and the Length of Life*, papers presented at a Seminar held in Fluggi Terme, Italy, sponsored by the USSP Committee on Factors Affecting Mortality and the Length of Life, 1982, Ordina Editions, Liege.

Ronder, L., *et al.*, "Seventy-Year-Old People in Gothenburg, A Population Study in an Industralized Swedish City," *Acta Medica Scandinavica*, 198:397-407, 1977.

Schwarz, Karl, "Public Health Implications of Stationary and Declining Populations," *World Health Statistics Report*, 30 (4):340-354, 1977.

Serow, William J., "Socioeconomic Implications of Changing Age Composition in Low Fertility Countries, Empirical Evidence: An Assessment, in Particular, of its Practical Significance," *International Population Conference, Manila, 1981*, International Union for the Scientific Study of Population, Liege, 1981.

Shanas, Ethel, and George L. Maddox, "Aging, Health, and the Organization of Health Resources," pp. 592-618 in Robert H. Binstock and Ethel Shanas (eds.), *Handbook of Aging and the Social Sciences*, Van Nostrand Reinhold, New York, 1976.

Shryock, Henry S., Jacob S. Siegel, and Associates, *The Methods and Materials of Demography* (2 vols.), Chapter 8, U. S. Bureau of the Census, Fourth Printing, U.S. Government Printing Office, Washington, D.C. 1980.

Siegel, Jacob S., 'Demographic Background for International Gerontological Studies," *Journal of Gerontology*, 36(1):93 102, 1981.

_____ , 'Prospective Trends in the Size and Structure of the Elderly Population, Impact of Mortality Trends, and Some Implications," in *Consequences of Changing U.S. Population: Demographics of Aging*, Joint Hearings before the Select Committee on Population and the Select Committee on Aging, U.S. House of Representatives, May 24, 1978, Vol. 1, Washington, D.C., 1978. Reprinted in U.S. Bureau of the Census, *Current Population Reports*, Series P-23, No. 78, 1979.

Smith, Joyce M., and Aubrey Sheiham, "How Dental Conditions Handicap the Elderly," *Community Dentistry and Oral Epidemiology*, 7:305-310, 1979.

Sourander, L.B., I. Ruikka, and A. Kasanen, "A Health Survey of the Aged with a 5-Year Follow Up," *Acta Socio-Medica Scandinavica*, Supplement, No. 3, 1970.

Spengler, Joseph J., *Toward Zero Population Growth: Reactions and Interpretations, Past and Present*, Duke University Press, Durham, North Carolina, 1978.

Svanborg, A., et al., "Seventy-Year Old People in Gothenburg: A Population Study in an Industrialized Swedish City," Chapter II, 'Social and Medical Conditions," *Acta Medica Scandinavica*, 200, 1977.

Taber, Merlin A. (special editor), "Alternatives to Nursing Home Care for the Frail Elderly: An International Symposium," *Gerontologist*, 20(3), June 1980, Part I.

United Nations, *The Aging of Populations and Its Economic and Social* Implications, Population Studies, No. 26, United Nations, New York, 1956.

_____ , *The Aging: Trends and Policies*, ST/ESA/22, United Nations, New York, 1975.

_____ , *Patterns of Urban and Rural Population Growth*, Population Studies, Series A, No. 68, United Nations, New York, 1980a, Chapters II and VIII.

_____ , *World Population Trends and Policies, 1979 Monitoring Report*, Volume I, *Population Trends*, Population Studies, Series A, No. 70, United Nations, New York, 1980 b, esp. Chapter III, p. 88, and pp. 103-104.

_____ , *World Population Prospects as Assessed in 1980*, Population Studies, Series A, No. 78, United Nations, New York, 1981.

_____ , Statistical Office, *Demographic Yearbook, 1978*, table 7, United Nations, New York 1980; *Demographic Yearbook* for various other years, 1970 to 1979.

_____ , *Age and Sex Structure of Urban and Rural Populations, 1970-2000: The 1980 Assessment*, ESA/P/WP.81, December 1982.

_____ , Statistical Office, *Annual Population and Vital Statistics Report*, Series A, various years, 1970 to 1980.

U.S. Bureau of the Census, *Illustrative Statistics on Women in Selected Developing Countries*, Washington, D.C., September 1980, tables 5 and 6.

_____ , *Demographic and Socioeconomic Aspects of Aging in the United States*, by Jacob S. Siegel and Maria Davidson, *Current Population Reports*, Series P-23, No. 138, August, 1983.

U.S. Public Health Service, National Center for Health Statistics, "Limitations of Activities and Mobility Due to Chronic Conditions, United States, 1972," by Charles W. Wilder, *Vital and Health Statistics*, Series 10, No. 96, November 1974.

_____ , "Current Estimates from the Health Interview Survey: United States, 1978," by Jimmie D. Givins, *Vital and Health Statistics*, Series 10, No. 130, November 1979.

U.S. Public Health Service, National Center for Health Statistics and National Center for Health Services Research, "Elderly People: The Population 65 Years and Over," by Mary Grace Kovar, Part A, Chapter I, in *Health, United States, 1976-1977*, 1978.

U.S. Public Health Service, Center for Disease Control, *Ten Leading Causes of Death in the United States, 1975*, Atlanta, Georgia, 1978.

Vallin, M.J., and J.C. Chesnais, "Evolution recente de la mortalite en Europe dans les pays Anglo-Saxons et en Union Sovietique, 1960-1970," *Population* (Paris), 29:862-898.

Verbrugge, Lois M., 'Recent Trends in Sex Mortality Differentials in the United States," *Women and Health*, 5(3):17-37, Fall 1980.

_____ , "Sex Differentials in Morbidity and Mortality in the United States," *Social Biology*, 23:275-296, 1976.

Vlassoff, M., and Carol Vlassoff, 'Old Age Security and the Utility of Children in Rural Areas," *Population Studies*, 34 (3):487-499, November 1980.

Walsh, John J., "Publicly Administered Systems of Health Care," in Morris F. Collen (ed.), *Technology and Health Care Systems in the 1980's*, Proceedings of a Conference, January 1972, San Francisco, U.S. Health Services and Mental Health Administration and U.S. National Center for Health Services Research and Developments, Rockville, MD., 1974.

Wiley, James A., and Terry C. Camacho, "Life-Style and Future Health: Evidence from the Alemeda County Study," *Preventive Medicine*, 9:1-21, 1980.

World Health Organization, "Sources of Medico-Social Information on the Elderly," Part II, *World Health Statistics Report*, 25(3):198-213, 1972.

_____ , "Community Water Supply and Sewage Disposal in Developing Countries," *World Health Statistics Report*, 26(11):720-783, esp. pp. 732-733 and 738-743, Geneva, 1973.

_____ , *World Health Statistics Report*, 27:688, 1974a, citing D.V. Granahan *et al.*, "Contents and Measurement of Socioeconomic Development," United Nations Research Institute for Social Development, New York, 1972.

_____ , "Health Trends and Prospects, 1950-2000," *World Health Statistics Report*, 27(10):670-706, 1974b.

_____ , "Disability Prevention and Rehabiltation," A 29/INF. DOC/1, Provisional Agenda item 2.5.16, Twenty-Ninth World Health Assembly, 28 April 1976.

_____ , Regional Office for Europe, "The Organization and Operations of Long-Term Care Services: Report of a Working Group," Uppsala, 12-15 April 1977, Copenhagen, 1978.

_____ , "Health and the Family: Studies on the Demography of Family Life Cycles and their Health Implications," World Health Organization, Geneva, 1978a.

_____ *Primary Health Care: Report of the International Conference on Primary Health Care, Alma-Ata, USSR, 1978*, World Health Organization, Geneva, 1978b.

World Health Organization, Regional Office for Europe, *Health for All by the Year 2000 in Industrialized Countries, Report of an Ad Hoc Meeting, Geneva, May 1980*, Copenhagen 1980.

World Health Organization et al., *Proceedings of the Meeting on Socioeconomic Determinants and Consequences of Mortality, Mexico City, June 1979*, World Health Organization, Geneva, 1981. See especially articles by:

Antonovsky, Aaron, "Implications of Socioeconomic Differentials in Mortality for the Health System," pp. 483-502;

Behm, Hugo, 'Socioeconomic Determinants of Mortality in Latin America," pp 139-170;

Bourgeois-Pichat, Jean, "Commentaries" on the paper by A.J. Fox, pp. 562-566;

Caldwell, J.C., "Education as a Factor in Mortality Decline: An Examination of Nigerian Data," pp. 172-192;

Chao, Dennis N.W., "Natural Resources and Life Expectation," pp. 435-482;

Dang-Ha-Doan, Bui, "La differenciation socio-economique de la mortalite: Essai d'appreciation de la conjoncture de recherche, pp. 589-602;

Gaisie, S.K., "Some Aspects of Socioeconomic Determinants of Mortality in Tropical Africa," pp. 193-207;

Hashmi, Sultan S., "Socioeconomic Determinants of Mortality Levels in Asia and the Pacific," pp. 119-136;

Silver, Jacques, "On Measuring the Effect of Income on Mortality," pp. 423-452;

Vallin, M.J., "Facteurs socio-economiques de la mortalite dans les pays developpes, pp. 266-302.

Young, V.R., "Diet as a Modifier of Aging and Longevity," *Federation Proceedings*, 38:1994-2000, 1979.

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